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APPLIED MYCOLOGY

MYCOLOGICAL PAPERS

No. 12. NOTES ON INDIAN FUNGI. III

By G. WATTS PADWICK

No. 13. A NOTE ON BANANA LEAF SPECKLE IN JAMAICA AND SOME ASSOCIATED FUNGI

By E. B. MARTYN

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REVIEW
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VOL. XXV — JANUARY — 1946

KEMP (H. K.) & BEARE (J. A.). **Lime-induced chlorosis of fruit trees.**—*J. Dep. Agric. S. Aust.*, xlviii, 12, pp. 526–529, 3 figs., 1945.

Lime-induced chlorosis of fruit trees occurs in many parts of South Australia in the lower rainfall areas. Experimental evidence showed that the condition was due to lack of iron in the trees, the high alkalinity of the soil rendering the element unavailable. Solid injections of organic iron salts just before bud-burst corrected the disorder for one season. Applications of ferrous sulphate to the soil by the 'crowbar hole' method, ½ lb. being placed in each of eight holes round each tree, shortly before bud-burst, in 1941 gave excellent results on apricots at Berri and pears at Renmark. In experiments at Berri in 1940, irrigation by a check-bank system to induce leaching gave a gradual permanent improvement in at least one instance.

BENNETT (S. H.), KEARNS (H. G. H.), & MARSH (R. W.). **A field trial on the combined control of codling moth and brown rot of Apples.**—*Rep. agric. hort. Res. Sta. Bristol, 1944*, pp. 157–161, [1945].

Cordon apple trees of the Cox's Orange Pippin variety given the normal routine lime-sulphur washes up to petal-fall stage and bearing a clean, moderately heavy crop of apples, were sprayed on 30th June, 1944, at the rate of 75 gals. per 25 trees with bouisol 4 pt., grade G oil emulsion 1 gal., and lead arsenate 3 lb.; or bouisol 4 pt., grade G oil emulsion 1 gal., and D.D.T. [dichlorodiphenyltrichlorethane: *R.A.M.*, xxiv, p. 328] 1 lb.; or fermate 2 lb., grade G oil emulsion 1 gal., and D.D.T. 1 lb., water in each case being added to make 100 gals. In October, the treated trees showed respectively $2{\cdot}05\pm0{\cdot}52$, $2{\cdot}15\pm0{\cdot}73$, $2{\cdot}20\pm0{\cdot}69$ per cent. fruit infection with brown rot (*Sclerotinia fructigena*) [ibid., xxii, p. 29], as compared with 10 per cent. in the controls. Codling moth (*Cydia pomonella*) infestation was so slight that the results with regard to this part were without significance. The washes containing bouisol caused serious defoliation and russeting, while the fermate wash was not phytocidal, but left a tenacious, disfiguring deposit.

PIENIAZEK (S. A.). **Pre-storage carbon dioxide treatments for control of Apple scald.**—*Plant Physiol.*, xx, 2, pp. 313–314, 1945.

In an experiment at the Rhode Island Agricultural Experiment Station the control of apple scald [*R.A.M.*, xxi, p. 457] was attempted by passing a slow stream of air containing 30 or 60 per cent. carbon dioxide through 5-gal. containers filled with fruit for 3, 6, and 10 days, respectively. After treatment, the fruits, which had been picked on 1st and 21st September, 1944, were stored together at 32° F. and on 28th January, 1945, were transferred to a room at 65° to 70°. Fruit picked on the former date and treated immediately with 30 and 60 per cent. carbon dioxide, respectively, gave 100 per cent. control for the 3-, 6-, and 10-day treatments, whereas the untreated showed 78 per cent. scald. Apples treated after a month of storage had from 6 to 24 per cent. scald. Untreated fruit picked on 21st September had 50 per cent. scald and immediate and delayed treatments gave good control,

with scald ranging from 0 to 20 per cent. Similar treatment at room temperatures gave erratic and inconclusive results.

ATKINSON (J. D.). **Manganese deficiency of Peach trees.**—*Orchard. N.Z.*, xxvii, 2, p. 8, 1 fig., 1944.

In the Teviot area of Central Otago, New Zealand, peach trees often develop foliage mottling, followed by general chlorosis and partial defoliation. The affected trees become unthrifty, and the yields are reduced.

In experiments carried out with J. Hume, diseased peaches were sprayed with magnesium sulphate, zinc sulphate, and manganese sulphate, each at 3 lb. per 100 gals., plus 2 lb. hydrated lime. The manganese-treated trees showed marked improvement in 21 days and in 35 days were comparable to the best in the block [cf. *R.A.M.*, xxii, p. 252]. The magnesium and zinc treatments had no effect. The manganese caused no injury to fruit or foliage, but superficial residues gave the fruit a blemished appearance.

SMITH (C. O.). **Inoculations of the evergreen species of Prunus (laurocerasus) with Tranzschelia pruni-spinosae.**—*Phytopathology*, xxxv, 7, pp. 572–574, 1 fig., 1945.

Inoculations at the Citrus Experiment Station, Riverside, California, with uredospores of Dunegan's form *discolor* of *Tranzschelia* [*Puccinia*] *pruni-spinosae* [*R.A.M.*, xvii, p. 756] from peach and *Prunus pumila* on five evergreen species of *Prunus* under humid conditions were successful only on *P. caroliniana* and *P. ilicifolia* and its var. *integrifolia*. On the former species, the definite, circular, often coalescent spots, 1 to 5 mm. in diameter, were dark brown at the centre with a surrounding zone of greenish-yellow, and bore a few uredospores of the rust. The infected tissues collapsed and soon broke away from the healthy ones, giving a shot-hole or ragged appearance to the leaf. Similar effects were produced on the latter species and its variety, but the lesions did not exceed 3 mm. in diameter and there was less shot-hole than on *P. caroliniana*. It would appear that *Puccinia pruni-spinosae* is unable to perpetuate itself on the evergreen species of *Prunus*, the uredospores for the infection of which proceed from some more susceptible host. *P. ilicifolia* has not yet been observed to show natural infection by *Puccinia pruni-spinosae* in California [ibid., xviii, p. 745].

MARSH (R. W.) & DICKINSON (D.). **The control of Black Currant leaf spot by dithiocarbamate sprays and the effects of spray residues on the canned fruit.**—*Rep. agric. hort. Res. Sta. Bristol, 1944*, pp. 150–157, 1 graph, [1945].

On 6th July, 1944, 15 days before cropping, Baldwin black currant bushes were sprayed against *Pseudopeziza ribis* [*R.A.M.*, xxiii, pp. 327, 449] with fermate containing 60 per cent. ferric dimethyl dithiocarbamate with a spreader at 2 lb. per 100 gals. water, approximately 45 gals. being used on 56 bushes, while other rows were treated with 2 lb. fermate mixed with 1 pint ester salts in 100 gals. water, 40 gals. spray being used per 56 bushes. Some of the bushes remained untreated. On 27th July, the treated and untreated bushes were given a post-cropping application of Bordeaux mixture (4–10–100), copper sebacate spray (4 lb. sebacate made into a paste with $\frac{1}{2}$ lb. agral L with a little water and diluted to make 100 gals. spray), or copper sebacate dust made by grinding together 4 lb. sebacate, 3 lb. silica, and 3 lb. gypsum. The quantities of material used were 35 to 40 gals. of spray or 5 lb. dust per 56 bushes.

The results obtained decisively demonstrated the value of fermate in the control of leaf spot, percentage foliage retention for the plots with a pre-crop spray and

then the three post-crop treatments and no such treatment being 70 and 81, 72 and 76, 66 and 76, and 66 and 73, respectively, and the corresponding figures for plots given no post-crop spray 57 and 66, 46 and 56, 34 and 46, and 24 and 21, respectively. The results also emphasized the greater effectiveness of the pre-cropping spray as against post-cropping treatments. The single application of fermate in early July with no subsequent treatment maintained until early October a higher level of control than was given by any post-cropping treatment. The supplementary post-cropping applications became of advantage only at the end of the season. Where no pre-cropping spray was applied, the value of the post-cropping treatments from mid-August onwards was, in descending order, Bordeaux mixture, sebacate spray, and sebacate dust. By early October, the plots given only the post-crop spray with Bordeaux mixture showed about the same amount of defoliation as those given only the pre-cropping treatment. Throughout July, August, and September, the pre-crop spray maintained better control than the post-crop Bordeaux treatment.

Storage trials with canned fruit bearing the fermate spray residue showed that the amount present produced no staining of the can and no discoloration of the contents. Preliminary tests indicated that this material, however, promotes the breakdown of vitamin C and interferes with the estimation of the vitamin.

Bremer (H.) & İşmen (H.). **How do the causal organisms of fruit rot get into the interior of the Figs?**—*Zir. Derg.*, iv, 44–45, pp. 109–112, 1943. [Turkish, with English summary. Received September, 1945.]

In order to solve the controversial problem of the mode of entry of fig-spoilage organisms [*R.A.M.*, xx, p. 483] into the interior of the fruits, Davey and Smith's experiments on uncaprified figs [ibid., xiii, p. 41] were repeated on caprified ones. The results indicated that a proportion of the organisms, which at first comprise largely bacteria, later *Fusarium* spp., and in the final stages *Aspergillus* spp. and yeasts, are introduced by insects, notably *Blastophaga grossorum*, while the remainder penetrate directly through the open 'eye'.

Thorold (C. A.). **Reported control of Panama disease.**—*Proc. agric. Soc. Trin. Tob.*, xlv, 1, pp. 39, 41, 1945.

Commenting on a recent article [by Scarseth: *R.A.M.*, xxiv, p. 198] on the control of banana Panama disease (*Fusarium* [*oxysporum* var.] *cubense*), the author states that experience in Trinidad and elsewhere confirms the opinion that the disease is worse on light acid soils than on heavier alkaline ones. The contention that the use of heavy applications of lime, with bulky organic matter, improves the condition of land abandoned as a result of infection is not new, F. E. V. Smith having reported the results of experiments along these lines in Jamaica in 1932. As the fungus has been found in the soil to a depth of at least 24 in., the lime should, naturally, be turned in deeply. It is certain that bananas benefit directly from improved soil conditions induced by the addition of organic matter, while there is likely to be also an indirect benefit brought about by a reduction of the fungus through the antagonism of other soil organisms.

Chowdhury (S.). **A leaf spot of Carica papaya caused by a new species of Phyllosticta.**—*Indian J. agric. Sci.*, xiv, 6, pp. 395–398, 1 col. pl., 1 fig., 1944.

In 1940, papaw (*Carica papaya*) plants in the vicinity of Haflong, Assam, developed a very serious leaf spot due to a species of *Phyllosticta*. The disease has been present ever since, and annually causes considerable damage.

The spots, which are found only on the leaves, vary considerably in size, some being small and rounded, 1 by 1 or $\frac{3}{4}$ mm., while others are irregular, oval, or

elongated, 3 to 15 by 2 to 11 mm. Almost white in the centre, they are often bounded by a yellowish or brownish margin which merges into the normal green of the leaf. The central portion of the spots is thin and papery, and finally it becomes brittle and drops out. When numerous spots are present, the leaf withers and falls.

Inoculations of healthy *C. papaya* plants in the laboratory, by spraying with a spore suspension of the fungus or placing mycelium and crushed pycnidia from a culture on unwounded leaf surfaces, gave 100 per cent. positive results (52 plants), while in outdoor tests, 217 inoculations were carried out by the latter method, with 97 per cent. successful results. All the controls remained healthy.

The organism is characterized by subepidermal, later erumpent, globose to subglobose, dark brown to black pycnidia, 80 to 115 by 60 to 95 μ, usually provided with distinct ostioles. The hyaline to subhyaline, straight to rarely slightly curved pycnospores are rounded at both ends and 5 to 10 by 2·5 to 3 μ. In culture on oat agar and *C. papaya* leaf juice agar the pycnidia measured 90 to 127 by 67 to 107 μ.

As the spore measurements are outside the probable range for the only two species of *P.* so far recorded on this host, *P. papayae* and *P. caricae-papayae*, the organism is regarded as a new species, and is named *P. sulata* Chowdhury n.sp.

The available evidence indicated that the parasite perpetuates itself in plant débris, and is disseminated by wind. The disease appears every year at the end of September when, though rainfall is scanty, there is heavy dew; this helps the pycnidia to burst, liberating the pycnospores and allowing them to germinate. The disease can be controlled by systematically collecting and burning affected leaves lying on the ground, and can be prevented (as was demonstrated experimentally) by spraying the plants with 1 per cent. Bordeaux mixture. Three applications should be made, at the end of August, on 15th September, and 15th October.

Leiserson (L.), Bost (R. W.), & Cameron (F. K.). **The importance of molecular structure in wetting agents.**—*J. Elisha Mitchell sci. Soc.*, lxi, 1–2, pp. 1–7, 1945.

A method of determining the rate of wetting in wetting agents, devised by Seyferth and Morgan (*Amer. Dyest. Reptr*, xxvii, p. 525, 1938), in which the rate at which a standard canvas disk sinks through the solution is observed, the observations according with the equation $t^n = kc$, where t is the sinking-time for a given distance, c the concentration, and n and k are constants, was applied to a number of commercial surface-active preparations. The [tabulated] results showed that of the 22 wetting agents tested, the three most efficient were aerosol OT [*R.A.M.*, xxii, p. 171] dry, santomerse [ibid., xxi, p. 111] D, and tergitol 7, while the two least efficient were igepon T gel and 85 per cent. Turkey red oil.

When various compounds were synthesized, it was found that sodium β-(amylonaphthoyl), conforming to a certain formula is very active and is an excellent wetting agent, but is precipitated by acids; a solution containing 0·8 gm. per l. sinks a canvas disk in 30 seconds. A solution containing 1 gm. iso-octyl β naphthol, 4 gm. sodium hydroxide, and 50 c.c. alcohol per l. sinks a canvas disk almost instantaneously. Observations on these substances and a condensation product confirmed the view that the presence of hydrophobic with hydrophilic groupings in a molecule makes for wetting activity. The presence of these groupings is not in itself a guarantee of effectiveness, but there must be a suitable arrangement of groupings, perhaps involving a balancing of internal stresses. In other words, the molecular structure is the dominant factor in determining effectiveness in a wetting agent.

Gäumann (E.). **Über Seuchenzüge bei pflanzlichen Infektionskrankheiten.** [On progressive epidemics in infectious plant diseases.]—*Experientia*, i, 5, pp. 153–157, 1 graph, 1 map, 1945. [English summary.]

The initiation of progressive epidemics in the plant world is governed by factors similar to those operating in the case of human diseases, the fulfilment of a series of conditions, notably the following, being demanded: (1) on the part of the host large populations of susceptible individuals, (2) on the part of the pathogen the existence of a high epidemiological potential, and (3) on the part of the environment optimal weather conditions for the development of the causal organism. The interplay of these factor-complexes is illustrated by the histories of white pine blister rust (*Cronartium ribicola*) and vine mildew (*Uncinula necator*), an interesting account of which is given.

Limasset (P.). **Principes de pathologie végétale. Notions sur les principales maladies parasitaires des plantes cultivées.** [The principles of plant pathology. Ideas on the chief parasitic diseases of cultivated plants.]—147 pp., 51 figs., Paris, Dunod, Éditeur, 1945.

In this book, intended chiefly for beginners, the author, after an introductory section dealing with parasitism and immunity and reviewing the history of plant pathology (pp. 1–16), devotes a long chapter (pp. 17–95) to plant mycoses and their control. Other chapters deal with bacterial diseases (pp. 96–106), virus diseases (pp. 107–126), parasitic phanerogams (pp. 127–130), and plant-pathological technique (pp. 131–136). There is a brief note on botanical classification, and a short but useful bibliography.

Heim (R.). **Les problèmes et les méthodes de la mycologie aux Colonies.** [Mycological problems and methods in the Colonies.]—*Conf. Off. Rech. sci. colon.*, pp. 133–158, 1943. [Received September, 1945.]

In this paper, read on 5th July, 1943, the author discusses the plant disease situation in the French colonies (where losses amounting to Fr. 1,000,000,000 per annum are caused), the training of phytopathologists and the organization of a colonial phytopathological service, based on a centre in France with documentation bureaux on the lines of the British Imperial Institutes and Bureaux.

Incidentally, it is stated that Panama disease of bananas (*Fusarium* [*oxysporum* var. *cubense*]) was observed for the first time in French Guinea in 1939.

Ajello (L.). **A simple method for preparing Corn meal agar.**—*Mycologia*, xxxvii, 5, pp. 636–637, 1945.

The author describes a simplified and quicker method of preparing maize meal agar using a 'Silex' [percolator] type coffee-pot fitted with a 'Cory' glass filter rod to extract the maize meal before adding the agar.

Talbot (P. H. B.). **A modification of slide-culture technique.**—*Nature, Lond.*, clvi, 3961, pp. 391–392, 1945.

A simple method of making slide-cultures for the study of moulds, devised by the author and M. C. White, is described. Melted nutrient agar is allowed to cool down to between 40° and 45° C., inoculated heavily with spores, and a drop transferred to a flamed slide with a platinum loop and covered with a flamed coverslip, the drop occupying a circle of about half the diameter of the coverslip. On inoculation in a moist Petri dish, the mycelium quickly spreads through the agar, and hyphae and sporophores develop in the air-space under the coverslip. Shear's mounting fluid may be introduced under the coverslip and the whole ringed with a cement, if desired.

Tint (H.). **An apparatus for the growth of plants under controlled temperature levels.**—*Phytopathology*, xxxv, 7, pp. 511–516, 1 fig., 1 diag., 1 graph, 1945.

A description is given of an apparatus consisting of a rectangular, insulated chamber, divided into compartments and furnished with heating and refrigerating units, one at each end, which permits the investigation of plant development simultaneously at several temperature levels [see below, p. 19]. The temperature fluctuations within their respective levels in the individual chambers simulate the normal diurnal range in the field under the influence of varying degrees of insulation. The cost of the materials for the apparatus was approximately $25.00 and the various installation expenses totalled less than $45.00.

Lapage (G.). **Two new antibiotics.**—*Nature, Lond.*, clvi, 3961, pp. 398–399, 1945.

After drawing attention to the existing need for an antiseptic or antibiotic that will effectively control Gram-negative micro-organisms, the author briefly discusses investigations recently carried out by various workers on streptomycin [*R.A.M.*, xxiv, p. 426] and streptothricin [ibid., xxiv, p. 463]. Both substances urgently require further clinical study.

Raper (K. B.) & Alexander (Dorothy F.). **Penicillin : V. Mycological aspects of penicillin production.**—*J. Elisha Mitchell sci. Soc.*, lxi, 1–2, pp. 74–113, 9 figs., 5 graphs, 1945.

A two-year study of natural variation and penicillin production in four different members of the *Penicillium notatum-chrysogenum* group used for the commercial production of penicillin, i.e., *P. notatum* Westling, the original Fleming isolate, and strains developed from it, including NRRL 1249. B 21, widely used for the production of penicillin in surface culture, *P. notatum*, NRRL 832, generally used for penicillin production in submerged culture, *P. notatum*, NRRL 1950, and strains from it that produce high yields in surface culture, and *P. chrysogenum* Thom, NRRL 195, and strains from it, including NRRL 1951. B 25, used for penicillin production in surface and submerged culture, gave the following results.

In variants of the Fleming culture characterized by progressively reduced spore production and decreased exudate formation, up to a certain level, represented by such strains as NRRL 1249. B 21, reduced sporulation is accompanied by an increased capacity to produce penicillin in surface culture. Beyond this level of sporulation, production declines as spore formation is further reduced. White, non-sporulating strains show low yields. *P. notatum*, NRRL 832, is relatively stable, but some less productive variants were isolated. The stock culture of *P. notatum*, NRRL 1950, is quite stable in ordinary laboratory culture, but an ultra-violet-induced mutation produced by Dr. G. W. Beadle and his associates is capable of producing substantially increased yields in surface culture. Very light-sporing variants produce low yields. *P. chrysogenum*, NRRL 1951, is most unstable, and substrains capable of producing substantially increased yields in surface and submerged culture were isolated. NRRL 1951. B 25, representative of the most productive type, also gave very light-sporing substrains with reduced yields.

Methods for maintaining cultures in the condition of highest production of penicillin are described.

Burkholder (P. R.) & Sinnott (E. W.). **Morphogenesis of fungus colonies in submerged shaken cultures.**—*Amer. J. Bot.*, xxxii, 7, pp. 424–431, 2 figs., 1945.

This paper describes the effect of environmental influences on the morphology of colonies of various fungi, and especially of *Penicillium notatum*, developed from spore germination to large colonies in shaken solutions of three kinds of nutrients. While undisturbed cultures formed surface mats, agitated cultures resulted in discrete, globose, usually prosenchymatous masses which commonly possess charac-

teristic metabolism, colour, texture, and surface features. Differences in the composition of the medium reacted noticeably on the rate of growth, texture, and surface features of the colonies, and alternating zones of different textures resulted from alternating changes of temperature and intermittent shakings. Delayed shaking gave rise to colonies of irregular shape. By the use of shaken liquid cultures three types of reaction can be distinguished: (1) reactions to unilateral orientating factors (e.g., gravity, unilateral light, and chemical gradients); (2) reactions to general or unorientated factors (temperature, chemical substances, and quality of light); and (3) reactions to factors in the internal environment alone (such as hormones and enzymes). The specificity of the reaction of each type is dependent upon the genetic constitution of the organism.

CARPENTER (C. W.), WELLER (D. M.), & MARTIN (J. P.). **Studies with Penicillium notatum Westling in Hawaii.**—*Hawaii. Plant. Rec.*, xlix, 1, pp. 1–23, 13 figs., 1 graph, 1945.

After a brief review of the discovery, properties, and production of penicillin and its application to medicine, the authors describe studies carried out in Hawaii (where the prevailing temperature is highly conducive to the growth of *Penicillium notatum*) in which methods were devised for preparing inoculated surgical gauze dressings. References are made to topical penicillin therapy and various clinical cases.

CARPENTER (C. W.). **Antibacterial properties of yeasts, Fusarium sp., Onion and Garlic.**—*Hawaii. Plant. Rec.*, xlix, 1, pp. 41–67, 9 figs., 1945.

A full account is given of studies carried out in Hawaii in the course of which the penicillin-sensitive *Staphylococcus aureus* and the penicillin-resistant, pus-forming bacteria *Pseudomonas aeruginosa* and *Bacillus* [*Bacterium*] *coli* were inhibited *in vitro* by *Torulopsis utilis*, and its vars. *thermophila* and *major*, and, to a less extent, by certain true yeasts, and by the juices and fumes of onion and garlic. Clinical cases are reported which indicate the anti-bacterial potency *in vivo* of *T. utilis* var. *major*. An undetermined variety of *Fusarium oxysporum* parasitic on *Opuntia megacantha* inhibited the growth *in vitro* of *S. aureus*, this being, apparently, the first record of the anti-bacterial potency of a *Fusarium* species against a human pathogen.

ROSENTHAL (L.). **Antagonistic action of a red mould pigment against bacteria of the typhoid-paratyphoid-dysentery group.**—*Science*, N.S., cii, 2642, pp. 176–177, 1945.

The author records the production of a red pigment, antibiotic to typhoid, paratyphoid and dysentery (strains of Shiga and Flexner) bacilli, from a fungus isolated from human hair, which produced no fruiting bodies under the conditions tested, and so could not be identified.

FITZGERALD MOORE (D.). **Torula utilis yeast or 'food' yeast.**—*J. trop. Med.* (*Hyg.*), xlviii, 4, pp. 75–77, 1945.

The claims advanced for the application of the yeast *Torula* [*Torulopsis*] *utilis* to the solution of colonial food problems, as expounded in the booklet 'A Venture in Practical Nutrition' [*R.A.M.*, xxiii, p. 399], are critically examined and discussed on the basis of long personal experience in the investigation of a B-complex deficiency state in Africa. In the author's opinion the main uses of the yeast will lie in three directions, namely, (1) the treatment of B-deficiency states, (2) as an indirect source of human nutriment, in so far as it may prove a valuable adjunct to concentrated feeding of domestic animals, and (3) in times of famine. Here he believes its real advantages will end.

Limasset (P.). **La mosaïque chronique des Pommes de terre de la variété Royal Kidney.** [Chronic mosaic of Royal Kidney Potatoes.]—Reprinted from *C.R. Acad. Agric. Fr.*, 4 pp., 1943. [Received September, 1945.]

The author identifies the cause of mosaic disease of the Royal Kidney potatoes in France as a rather weak strain of virus X. Experimental evidence confirmed the view that it is possible to protect tobacco against virulent strains of the same virus by prior inoculation with an attenuated strain, though this is not at present a practicable method of control.

Foister (C. E.), Wilson (A. R.), & Boyd (A. E. W.). **Control of dry rot of seed Potatoes by dusting.**—*Nature, Lond.*, clvi, 3961, p. 394, 1945.

During the past three years, large-scale tests have been carried out in Scotland, under conditions approaching those obtaining in commercial practice, of the treatment of seed potatoes against dry rot (*Fusarium caeruleum*) [*R.A.M.*, xxiii, p. 38] by dusting with thymol, used at the rate of 12 oz. thymol made up to 10 lb. with kaolin, per ton of potatoes. A double application, i.e., on lifting and on riddling for despatch to England, gave excellent control, which, on the average, was slightly better than that given by the standard single treatment with an organo-mercury dip. Treated Catriona tubers despatched in December, Arran Pilot in December and March, and Doon Star in December and March, showed in April only 1, 1, 5, 4, and 3 per cent. infection, respectively, as against 17, 46, 19, 31, and 32 per cent. infection for the corresponding untreated lots. Some tubers showed, however, marked phytocidal effects from the treatment, though Doon Star was much less injured than Arran Pilot, and in some cases was almost undamaged. On the other hand, the treatment was found easy to carry out and inexpensive. It appears to have possibilities.

Jones (W.). **Pink rot disease of Potatoes in British Columbia.**—*Sci. Agric.*, xxv, 10, pp. 596–600, 2 pl., 1945.

This paper describes an investigation of potato pink rot disease (*Phytophthora erythroseptica*) [*R.A.M.*, xix, p. 40; xxiii, p. 56], a few tubers affected by which were obtained from the Okanagan district of British Columbia in 1943. In artificially inoculated tubers the most characteristic external symptom was a dark discoloration of the lenticels. The skin was dull and the eyes rather purple. The flesh on cutting was dirty white and became salmon-pink in half-an-hour. Warba, Epicure, Irish Cobbler, White Rose, Netted Gem, Burbank, Green Mountain, Columbia Russet, and Sequoia all proved equally susceptible to the pathogen. The disease was produced in mother- and young tubers from plants grown in soil inoculated with *P. erythroseptica*, accompanied by necrosis of the stolons, sprouts, and basal parts of the stems, and wilt of some leaves towards the end of the growing period. The optimum temperature for the growth of the fungus is approximately 24° C., the minimum between 4° and 8°, and the maximum below 34°. The optimum for disease development in the Burbank variety is approximately 25°. Crop rotation, destruction of diseased refuse, and careful grading before storage or marketing are recommended measures of control.

Teakle (L. J. H.). **Experiments with micro-elements for the growth of crops in Western Australia.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xxii, 2, pp. 147–148, 1945.

Potatoes grown on swamp land near East Narrikup, Western Australia, made unsatisfactory growth, the first crop yielding 13 tons per acre, the next about half, and the third failed. Applications of managanese sulphate at the rate of 132 lb. per acre in 1944 and 28 lb. in 1945 secured yields of 8 and 5 tons and greatly exceeded the results obtained with Epsom salts [magnesium sulphate], borax, copper sulphate, or zinc sulphate [*R.A.M.*, xviii, p. 95; xxi, p. 92]. Manganese

deficiency is indicated by a bronzing or yellowing of the leaf, accompanied by unthrifty growth. It is recommended that potatoes showing unsatisfactory growth on swamp land should be treated with 28 to 56 lb. manganese sulphate per acre with the potato manure.

STEVENSON (J. A.) & IMLE (E. P.). **Periconia blight of Hevea.**—*Mycologia*, xxxvii, 5, pp. 576–581, 4 figs., 1945.

In December, 1943, a severe leaf-spotting of *Hevea spruceana* was observed at Turrialba, Costa Rica, and, after a long period of rain, the disease became epiphytotic and caused minor damage to *H. brasiliensis* seedlings. The same disease was observed earlier by W. J. Martin on *H. brasiliensis* in Mexico.

The leaf spots are circular to oval, at times rather elongated along the veins, but not vein-limited, appearing much the same on both surfaces. Primary lesions vary in diameter from 2 to 10 mm., but frequently coalesce, particularly on young leaves, so that the whole leaf surface may be covered, with the result that premature abscission may occur. The spots are brown at first, becoming ashen at the centre with a brown border, and on mature leaves they are often ringed by a chlorotic halo. Necrotic areas split irregularly and may even fall away. Petiole lesions are common and cause leaf abrasions or petiole breakage if severe. Sometimes the petiole lesions or leaf spots spread down to the leaf axils and cause sunken twig cankers or dieback of young, soft twigs.

The disease has been found also on *H. guianensis*, *H. benthamiana*, and on hybrids of *H. brasiliensis* × *H. spruceana*. *H. spruceana* clones selected for resistance to South American leaf blight (*Dothidella* [or *Melanopsammopsis*] *ulei*) [*R.A.M.*, xxiii, p. 455] are readily susceptible to the new pathogen when grown with thin shade. The available evidence indicates that the disease is not likely to become an important factor on *H. brasiliensis*, except when grown with *H. spruceana*.

A species of *Periconia* has been found constantly associated with the diseased areas and has relatively large, black conidiophores, 250 to 400 μ long, with a bulbous basal cell, 45 to 90 μ long, 24 to 30 μ in diameter at the base, 15 to 18 μ above, surrounded with a whorl of sporogenous cells at the base, these bearing globose, deep brown, strongly verrucose conidia. They have a short, clavate, apical cell, 25 to 45 μ in diameter, short catenulate, the terminal conidium only reaching extreme size. Very few species of *Periconia* have been reported as plant parasites and none hitherto on members of the Euphorbiaceae; all differ from the species on *Hevea* in having much smaller conidia and in other specifically morphological characters. It is considered, therefore, to be new and is named *P. heveae*.

HEWITT (E. J.). **Experiments in mineral nutrition. II. The visual symptoms of mineral deficiencies in crop plants grown in sand cultures. Progress Report, 1944.**—*Rep. agric. hort. Res. Sta. Bristol, 1944*, pp. 50–60, [1945].

Continuing his survey of the visual symptoms of mineral deficiencies in crop plants [*R.A.M.*, xxiii, p. 457] the author presents in tabular form the deficiency symptoms observed on 28 crops grown in controlled nutrient deficiency sand cultures.

NICHOLAS (D. J. D.) & JONES (J. O.). **The application of rapid chemical tests to plant tissues in the diagnosis of deficiencies of mineral nutrients. Progress report I.**—*Rep. agric. hort. Res. Sta. Bristol, 1944*, pp. 84–97, [1945].

Experiments [which are described and the results of which are tabulated] made with the tissue-test method of assessing the mineral status of plants, using fresh plant material with known deficiencies or grown with known nutrient treatment, showed that there was a fair degree of correlation between visual symptoms,

manurial treatment, and the tissue-test data. The tissue-test results invariably agreed with the severity of the deficiency symptoms. The evidence obtained suggests that the tissue-test will prove valuable for diagnostic purposes, though further work is necessary to solve certain problems.

Chowdhury (S.). **Rhizoctonia root-rot of Pan (Piper betle) in relation to manuring.** —*Indian J. agric. Sci.*, xiv, 6, pp. 391–394, 1944.

After stating that root rot (*Rhizoctonia* [*Corticium*] *solani*) of *Piper betle*, the only manure used for which is mustard oil-cake, is very serious in Assam, and causes heavy damage wherever it occurs [*R.A.M.*, xxiv, p. 248], the author describes experiments with different manures, which demonstrated that the percentage of deaths of *P. betle* plants from infection by *C. solani* is not affected by the nature of the fertilizer used. The figure was virtually the same in plots given oil-cake, sodium nitrate, ammonium sulphate singly, or sodium nitrate or ammonium sulphate in combinations with superphosphate and potassium sulphate. The yield of leaves, however, was slightly greater in the plots receiving oil-cake than in the remainder.

Uppal (B. N.), Verma (P. M.), & Capoor (S. P.). **A mosaic disease of Cardamom.**—*Curr. Sci.*, xiv, 8, pp. 208–209, 1945.

Cardamom (*Elettaria cardamomum*) mosaic [*R.A.M.*, xviii, p. 89; xxi, p. 464] occurs in Travancore, Mysore, and North Kanara. The first visible symptoms appear as a general chlorosis of the whole leaf, with thin, broken stripes of deep green tissue over the surface. These stripes follow the veins and run parallel to one another from the midrib to the leaf margin. When the disease is fully developed, the stripes are more or less evenly distributed. In nature, the plants are susceptible at all stages of growth. The affected clumps quickly deteriorate. Newly formed shoots from such clumps are small, and show gradual reduction in productivity, followed by death. Many clumps wither before beginning to yield.

Experimental evidence showed that the disease is not soil-borne, while all attempts at transmission by sap inoculation also gave negative results. Infection was, however, transmitted by *Pentalonia nigronervosa* in 21 to 46 days after transfer to healthy cardamoms in insect-proof glasshouses.

Zogg (H.). **Die Herzfäule des Oelmohns und ihre Bekämpfung.** [Opium Poppy heart rot and its control.]—*Flugbl. landw. VersAnst. Zürich-Oerlikon* 14, 4 pp., 4 figs., 1944.

Opium poppies in Switzerland have of late years developed the characteristic symptoms of heart rot associated with boron deficiency [*R.A.M.*, xxiii, p. 189], including rolling of the leaves along the midrib and stunting or distortion of the heart, rapidly followed by a dark purple discoloration and decay involving the upper portions of the stem or the entire plant. Alternatively, flowering may proceed normally, but after the fall of the misshapen petals, either the young ovary will be found showing a blue tinge or at least the capsule, also partially discoloured, will be bent over to one side. At the same time the leaf axes and portions of the stem show a similar change of colour, the latter organs also frequently bearing blisters and cracks through which the darkening juice exudes. At this advanced stage of the disease the plants often collapse suddenly: the stem is hollow and the liquefied medulla flows out when the base is cut.

Preventive soil treatments with borax or boric acid at dosages of 20 and 12 kg. per ha., respectively, have given satisfactory results. Curative measures are ineffectual.

CARVAJAL (F.). **The relation between Vermicularia graminicola West. reported on Sugar Cane and Physalospora tucumanensis Speg.**—*Mycologia*, xxxvii, 5, pp. 637–638, 1945.

The writer considers Spegazzini's specimen of *Vermicularia graminicola* West. on sugar-cane leaves collected in the Argentine (*Rev. Fac. Agron., B. Aires*, ii, pp. 227–258, 1896) specific with *Physalospora tucumanensis* [*R.A.M.*, xxiii, p. 358] on the ground that the conidial and perithecial states found in the specimen are reasonably coincident with those of the red-rot fungus studied by him in Louisiana.

HIRSCHHORN (ELISA). **Algunos caracteres del 'carbón' de la Caña de Azúcar en la Argentina (Ustilago scitaminea Sydow).** [Some characters of the Sugar-Cane smut (*Ustilago scitaminea* Sydow) in Argentina.]—*Not. Mus. La Plata*, viii, pp. 23–39, 1 pl., 4 figs., 1943. [Received October, 1945.]

The available information concerning the geographical distribution of sugar-cane smut (*Ustilago scitaminea*) in Argentina, its relation to climatic and physiological factors, the varieties attacked, and the economic importance of the disease is summarized, and the morphological characters of 300 specimens (all except three from Tucumán) described and critically discussed. As already mentioned by G. L. Fawcett [*R.A.M.*, xxiv, p. 74], the author divides the material into six groups, of which No. 4, characterized by two types of chlamydospores (*a*) golden to greyish, globose, 11 μ in diameter, with a tenuous, conspicuously echinulate membrane, and (*b*) reddish, globose or irregular, 5 to 6 μ in diameter, with an almost smooth membrane, approximates most nearly to Mundkur's *U. scitaminea* var. *sacchari-officinarum*. The chlamydospores of the other groups are distinguished by the following features: (1) chestnut to greyish, globose or subglobose, 5·7 to 7·5 μ in diameter, with a somewhat verrucose membrane; (2) chestnut to golden or reddish, globose, subglobose, or elliptical, 4 to 7·5 μ in diameter, with a slightly echinulate membrane, 1·5 to 2 μ in thickness; (3) dark chestnut to nearly black, globose or irregularly polygonal, 5·5 to 9 μ in diameter, with an almost smooth or barely punctate membrane, 1 to 3 μ in thickness; (4) golden-reddish or nearly black, very lustrous, irregular, 5 to 7·5 μ in diameter, with a small or barely punctate membrane, 3 μ in thickness; (5) lemon-coloured, globose, 4 to 5 μ in diameter, with a tenuous, highly echinulate membrane. Group 1 is considered to agree with the type species. The germination of the chlamydospores of five groups is described and figured.

CUMMINS (G. B.). **Additions to the Uredinales of Peru.**—*Mycologia*, xxxvii, 5, pp. 609–618, 5 figs., 1945.

This list contains 49 species of Uredinales reported from Peru, including five new species and 24 not mentioned by Garcia Rada and Stevenson [*R.A.M.*, xxiii, p. 316].

THIRUMALACHAR (M. J.). **Some noteworthy rusts. I.**—*Mycologia*, xxxvii, 3, pp. 295–310, 21 figs., 1945.

Descriptions are given of six rusts found in Mysore, including a new genus, *Acervulopsora*. A study of the morphology of the spore forms and of the life-cycle of *Uromyces mucunae*, which is abundantly present on *Mucuna pruriens* in the vicinity of Bangalore, showed that the uredosori are hypophyllous, scattered over the whole surface of the leaves, while the uredospores are hyaline, with a densely echinulate exospore, and have four scattered germ-pores. The teleutosori which replace the uredosori are brownish-black. The teleutospores are chestnut-brown, with a blackish tinge, globose, and have an apical, indistinct germ pore. The

exospore presents numerous warts in longitudinal rows. The teleutospores germinate only after a period of rest, giving rise to amphigenous, subepidermal, flask-shaped pycnidia showing well-developed ostiolar hyphae. The uredospores readily germinated and induced secondary infection.

HIRSCHHORN (ELISA). **Las especies de Sorosporium de la flora argentina.** [The species of *Sorosporium* of the Argentinian flora.]—*Rev. Mus. La Plata*, N.S., iii, Secc. bot., pp. 335–354, 4 pl., 2 figs., 2 graphs, 1941. [English summary. Received October, 1945.]

This paper opens with a brief discussion of the generic characters of *Sorosporium*, the life-history of the type species, *S. saponariae*, and the economic importance in Argentina, notably of *S. reilianum* [*Sphacelotheca reiliana*] on maize and sorghum, and to a less extent of *Sorosporium paranensis* n.sp. on *Axonopus compressus*, a valuable forage crop of sandy or semi-sandy soils, and of *S. platensis* n.sp. on *Andropogon saccharoides*, *A. imperatoides*, and *A.* sp. Up to the time of writing, no statistical survey of the damage caused by *Sphacelotheca reiliana* in the Republic had been undertaken, but in 1936–7 the incidence of infection on maize in Entre Ríos, where the crop is extensively cultivated, was estimated at 10 to 15 per cent., while heavy losses are also periodically reported from the Pergamino district of Buenos Aires. Sorghum appears to sustain less injury than maize under comparable conditions. *Sorosporium paranensis* has been observed in Entre Ríos and Buenos Aires destroying the inflorescences and entirely preventing seed production in every plant of *Axonopus compressus* in plots covering 100 sq. m. Similar effects are produced on the above-mentioned *Andropogon* spp. by *S. platensis*.

The author then describes the results of her analysis of material supplied by the Spegazzini Botanical Institute and the Laboratory of the Faculty of Agronomy of the National University of La Plata, as well as by various specialists, which led to the establishment of three species new to science, two new to the Argentinian flora, three hosts not yet recorded as harbouring *Sphacelotheca reiliana* in the Republic (namely, sorghum, *Sorghum bicolor* var. *charisianum*, and *S. cafforum* var. *albo-fuscum*), a revised diagnosis of *Sorosporium antarcticum* Speg., and the provision of a key to the Argentinian species of *Sorosporium*.

The golden or orange chlamydospores of *S. paranensis* may be either circular, 6 to 10 μ in diameter, or ovate to slightly rhomboid, 15 to 11 by 6 to 7 μ, and are furnished with a faintly or barely echinulate membrane, 0·5 μ in thickness, while those of *S. platensis* are olivaceous, chestnut or golden, either globose or polygonal, 7 to 11 μ in diameter, or somewhat ovate, 9 to 11 by 6 to 7 μ, with a tenuous, slightly spinulate membrane.

O[REJUELA] (C. G.). **A correction.**—*Mycologia*, xxxvii, 3, pp. 389–390, 1945.

In this note the author cites a passage accidentally omitted from his recent paper on the higher Ascomycetes in Columbia and Venezuela [*R.A.M.*, xxiv, p. 75].

JAMALAINEN (E. A.). **Über die Fusarien Finnlands. I, II, III.** [On the *Fusaria* of Finland.]—*Valt. Maatalousk. Julk.* 122, 26 pp., 5 figs., 1943; 123, 25 pp., 6 figs., 1943; 124, 24 pp., 8 figs., 1944. [Finnish summary.]

The author presents three lists, with brief historical and descriptive details, of the species of *Fusarium* found in Finland and pathogenic to crops and trees of the country: *F. nivale* [*Calonectria graminicola*] [*R.A.M.*, xxii, p. 471] mostly on winter rye; *F. sambucinum* mostly on *Picea excelsa* [*P. abies*] and potato tubers [ibid., xxiii, p. 476], *F. sambucinum* form 2 Wollenw. on a *P. abies* seedling; *F. culmorum* on grains of spring wheat and *F. graminearum* [*Gibberella zeae*] usually on oats, barley, and wheat; *F. poae* [ibid., xxii, p. 265], mostly on stems

of spring wheat in the south and the central part of northern Finland; *F. citriforme* n.sp., mostly on seed of various cereal crops (conidia somewhat piriform or rounded, mostly unicellular, occasionally 1- to 4-septate, measuring 9·6 by 6·1 μ, mostly 8 to 12 by 5·5 to 7 (6 to 14 by 3·6 to 9·4) μ; when 0- or 1-septate they are at first citriform, each end apiculate, occasionally globose or piriform; a few are ellipsoidal-fusiform, 0- to 2-septate, and 10 to 20 by 2·2 to 4·2 μ; when 3- to 4-septate, falcate, sharp at each end; when 3-septate measuring 23 to 30 by 2 to 4 μ); *F. sporotrichoides* on cereal crops [ibid., xx, p. 353], *Lolium perenne*, and red clover (*Trifolium pratense*); *F. avenaceum* on wheat (grain and stems), barley (grain), oats (one record only), and potatoes; *F. avenaceum* form 1 on *P. abies* and potatoes; *F. caeruleum* on potatoes; and *F. solani* on barley grain, *P. abies*, rhubarb leaves, and rotted potatoes; *F. merismoides* on potatoes with one record on *P. abies*; *F. anguioides* on rhubarb (one record); *F. scirpi* var. *acuminatum* on *Agrostis tenuis*, onions, *Crataegus coccinea*, barley ears, rye grain, tomato fruit, rotted potatoes, and ears of spring wheat; *F. bulbigenum* on cucumber fruit and barley grain; *F. oxysporum* var. *aurantiacum* [ibid., xxii, p. 58] on the neck of onions and on sugar beet; *F. redolens* [loc. cit.] on *Pinus sylvestris*; *F. arthrosporioides* on oats ears, beetroot, barley ears, *Picea abies*, winter rye ears, potato tubers, and the stems of spring wheat; and *F. detonianum* on oats, barley, winter wheat, and an ear of spring wheat (four single records only).

Moreau (F.) & Moreau (Mme). **Recherches sur les Saprolegniées.** [Studies on the Saprolegniales.]—*Ann. Sci. nat., Bot.*, Sér. 11, i, 2, pp. 221–358, 24 pl., 1 fig., 20 graphs, 1940. [Received September, 1945.]

The authors' exhaustive studies on seven members of the Saprolegniales, comprising four species of *Saprolegnia* and three of *Achyla*, fall into four chapters, dealing, respectively, with the culture, taxonomy, physiology, and cytology of the order [*R.A.M.*, xvii, p. 347]. A three-page bibliography is appended.

Mhatre (J. R.) & Mundkur (B. B.). **The Synchytria of India.**—*Lloydia*, viii, 2, pp. 131–138, 1945.

After a preliminary note on the genus *Synchytrium*, with special reference to its occurrence in India, the authors give technical descriptions based on the Indian collections of the 15 species now recorded from that country, including three new records and six which are considered to be new species. Mention may be made of *S. trichosanthidis* n.sp., *S. lagenariae* n.sp., and *S. piperi* n.sp. The first-named attacks the fruit and leaves of *Trichosanthes dioica*, a cucurbit of much importance as a vegetable locally; the affected fruits turn yellow and lose their flavour, with resultant loss in market value. The host surface is covered with white crust-like galls, 0·1 to 0·3 mm. in diameter. The smooth, spherical, olive- to dark brown resting spores, one or two in each cell, measure 64 to 95 μ. *S. lagenariae* produces dirty white, crust-like, light brown, sometimes cupulate galls, 0·2 to 0·4 mm. in diameter, on the leaves of *Lagenaria vulgaris*; the resting spores, one in each cell, are globose, smooth, lemon-yellow, thin-walled, 39 to 86 μ in diameter. *S. piperi* forms galls as minute, white dots on the leaves of *Piper betle*; the resting spores, one in each cell, are spherical, smooth, thin-walled, light brown, 30 to 38 μ in diameter.

Chodat (F.). **Emploi des rayons ultra-violets pour la classification des levures.** [Use of ultra-violet rays for the classification of yeasts.]—*Verh. schweiz. naturf. Ges.*, cxxiii, pp. 131–132, 1944.

Examined under ultra-violet light yeast (*Endomyces*, (?) *Hansenula*, *Torulopsis*, and *Mycoderma* spp.) colonies on beer wort agar assume either a pale to white or

dark to black coloration, while the presence of contaminants, invisible under white light, is revealed by a mosaic of alternating pale and dark zones. Lamps applicable for this purpose include Hanau or Philora HPW 120, provided with filters of Wood's glass, and Ulvir with a nickel oxide filter to eliminate the infra-red rays.

KOCH (L. W.). **The 1945 epidemic of blue mould of Tobacco in Ontario.**—*Lighter (Dep. Agric. Can.)*, xv, 3, pp. 1–4, 1945.

Tobacco blue mould (*Peronospora tabacina*) first appeared in Canada in 1938 [*R.A.M.*, xx, p. 429], near Essex, Ontario, additional outbreaks occurring later in the same year near Harrow and Blenheim. All these localities are in the Old Tobacco Belt, and the available evidence indicated that the most probable source of infection was air-borne sporangia carried across Lake Erie from Pennsylvania, Ohio, and, perhaps, Massachusetts and Connecticut. In 1939, the disease reappeared in the same district, but only on two farms. There was no record of any infection in the next three years, but in 1943 one case was reported, and in 1944 another. Up to this time, all diseased seedlings had been carefully eradicated. In 1945, however, blue mould reappeared in epiphytotic form in the entire Old Tobacco Belt and finally attained a similar intensity throughout a great part of the New Tobacco Belt.

Though the mould in North America has been almost exclusively a seedling disease, damage did not cease on transplanting to the field. In certain areas of the New Belt, fields up to 10 acres in size showed a high percentage of plants with one or more leaves affected, particularly the lower ones.

All the evidence indicates that masses of sporangia carried by air currents from the tobacco-growing areas of the United States were the source of the 1945 epidemic. Initial infection occurred in Ontario over widespread areas in a period of a few days to a week. Growers also agreed that infection originated in the beds in one small area as a patch of yellowed or wilted plants which underwent little change for a week to ten days, after which the whole had suddenly become infected. These symptoms indicate infection by sporangia rather than oospores. Control measures with paradichlorobenzene in cotton-covered beds and fixed copper for the glass-covered were carried out, with variable but generally satisfactory results.

GRAM (E.). **Tobaksavl. Mosaiksyge og andre virussygdomme paa Tobak.** [Tobacco cultivation. Mosaic disease and other virus diseases of Tobacco.]—*Vejl. Akad. tekn. Vidensk.* 3, pp. 1–7, 1 col. pl., 2 figs., 1943. [Received August, 1945.]

This is a popular note on the virus diseases affecting Danish tobacco crops, with special reference to the tobacco mosaic virus, an investigation of which by H. P. Hansen was in progress at the time of writing. The symptoms are briefly described and differentiated from the somewhat similar effects of various non-parasitic agencies. Control measures are indicated.

LIMASSET (P.). **Sur un effet de renforcement réciproque de l'action de deux virus dans une maladie complexe du Tabac et de la Tomate.** [On a mutually reinforcing effect of the action of two viruses in a complex disease of Tobacco and Tomato.]—Reprinted from *C.R. Acad. Agric. Fr.*, 3 pp., 1944.

In 1943, young shoots of a topped tobacco plant inoculated with tobacco mosaic virus, developed malformed leaves, referred to as 'pseudo-vrilles' or pseudo-tendrils, which were later found to be infected both by tobacco mosaic and cucumber virus 1 [cucumber mosaic virus]. The disease was transmitted by mechanical inoculation to tobacco and tomato.

CROXALL (H. E.). **The effects of copper sprays on marketable yield and storage rots of outdoor Tomatoes.**—*Rep. agric. hort. Res. Sta. Bristol, 1944*, pp. 161–166, [1945].

In spraying trials against blight (*Phytophthora infestans*) and fruit rot (*Didymella lycopersici*), outdoor tomatoes of six different varieties were sprayed with copper oxychloride at intervals of one, two, and four weeks, and with copper sebacate at intervals of two and four weeks, in both cases over a total period of twelve weeks [cf. *R.A.M.*, xxiii, p. 462]. No blight occurred on any plot (including the controls) throughout the season. None of the treatments caused any appreciable damage. With the varieties Ailsa Craig and E.S. 1, the sprayed plots gave significantly higher yields than the unsprayed (15·83 and 16·00 tons per acre of total fruit picked for plants sprayed at four-weekly intervals with copper oxychloride, and 15·15 and 15·48 for those treated similarly with copper sebacate against 11·43 and 13·85 for the controls, respectively), probably owing to partial control of *D. lycopersici* in the former. During the ripening of green fruit in storage, considerable losses were sustained as a result of infection by *D. lycopersici* and, to a less extent, by *Botrytis* [? *cinerea*], but the losses were significantly less in the sprayed than in the unsprayed fruit, the greatest reduction being in the lots given 12 applications of copper oxychloride. It would seem that the possibility of devising a spray programme that would protect tomatoes in the field against *D. lycopersici* might be worth further investigation.

JONES (J. O.), NICHOLAS (D. J. D.), WALLACE (T.), & JEFFERISS (A.). **Experiments on the control of magnesium deficiency in glasshouse Tomatoes. Progress Report II.**—*Rep. agric. hort. Res. Sta. Bristol, 1944*, pp. 61–71, [1945].

Experiments on the control of magnesium deficiency in glasshouse tomatoes [*R.A.M.*, xxiii, p. 461], carried out at five centres in 1944, showed that base dressings of magnesium sulphate (30 per cent. MgO) at the rate of 6 cwt. per acre gave only partial control. To secure commercial control a rate of 10 cwt. was necessary, but dressings at rates higher than this were no more effective. Liquid dressings to the soil during the growing period at a total rate of 5 cwt. per acre were relatively ineffective. Complete control was, however, secured even in severe cases by three or four spray applications during the growing season, using total amounts of magnesium sulphate of only $1\frac{1}{2}$ and 5 cwt. per acre, respectively. Chemical data from leaves in the mid-stem region indicated that a value of 0·5 per cent. MgO in dry matter is a 'threshold value' between sufficiency and deficiency.

RAYNER (M[ABEL] C.). **Trees and toadstools.**—71 pp., 18 pl., London, Faber & Faber, 1945. 6*s*. 0*d*.

In this attractively produced book, the author describes in lucid and simple language some of the commonly known toadstool-producing fungi and their association, pathogenic, symbiotic, and antibiotic, with our common trees and shows how plants belonging to widely different groups are interrelated with each other and with the mechanism of life as a whole. The writer concludes by seeing the soil as itself like human society, with manifold vital activities carried on by its numerous living inhabitants, to which trees and toadstools belong.

BLAKE (M. A.) & EDGERTON (L. J.). **Experiences with blight-resistant Chestnuts in New Jersey.**—*Bull. N. J. agric. Exp. Sta.* 717, 20 pp., 12 figs., 1945.

In this account of chestnut-growing in New Jersey in relation to blight [*Endothia parasitica*: *R.A.M.*, xxiii, p. 367], the authors describe the distinguishing characters of the four chief species and state that the Chinese chestnut (*Castanea mollissima*) appears to be the most promising of the resistant varieties. It is more resistant than either the Japanese chestnut (*C. crenata*) or the European (*C. sativa*), and the

nuts combine the large size of the European with the high quality of the native species (*C. dentata*). The Henry chinkapin variety (*C. henryi*), also native to China, has now been introduced, and is reported to be resistant. It may prove useful as a timber tree, and is under test in various places.

Hirt (R. R.) & Lowe (J. L.). **Polyporus versicolor on Asiatic Chestnut.**—*Phytopathology*, xxxv, 7, pp. 574–575, 1 fig., 1945.

In the autumn of 1944 an Asiatic chestnut [? *Castanea crenata* or *C. mollissima*] tree at the New York State College of Forestry was observed to bear the sporophores of *Polyporus* [*Polystictus*] *versicolor* on two branches, while the spongy heart rot typical of the fungus was present in the trunk and branch heartwood. These chestnuts have now begun to be put on sale in the United States, and their susceptibility to pathogenic fungi is therefore a matter of general concern to plant pathologists and tree specialists. *P. versicolor* is known to cause heartwood decay in living *Catalpa*, black cherry [*Prunus serotina*: *R.A.M.*, xxiii, p. 123], London plane (*Platanus acerifolia*) [ibid., xxiii, p. 83], apple, pear, and plum [ibid., xvi, p. 106], with consequent weakening and enhanced susceptibility to wind, snow, and ice damage.

Sarasola (A. A.). **Nuevas observaciones sobre la cancrosis de los Alamos.** [New observations on Poplar canker.]—*Rev. argent. Agron.*, xii, 2, pp. 115–119, 1 pl., 1945. [English summary.]

Continuing his studies on poplar canker in Argentina [*R.A.M.*, xxiii, p. 365], the writer records the detection of the pycnidial stage of the causal organism, *Septoria musiva* [ibid., xx, p. 386] in a number of fresh localities in the province of Buenos Aires. The Lombardy poplar (*Populus nigra italica*) was uniformly resistant to the disease under natural conditions, but other 'varieties', the hybrid Arnaldo Mussolini, for instance, sustained increasingly heavy damage after the second or third year. The severity of infection appears to be influenced by atmospheric humidity and soil height.

The perfect stage of the pathogen, *Mycosphaerella populorum* [loc. cit.] developed from pycnidia on *P. laurifolia* and Arnaldo Mussolini leaves collected in the autumn of 1943 and suspended during the following winter in wire baskets among infected branches at the Delta experimental farm. The dimensions of the perithecia, asci, and ascospores thus obtained differed appreciably from those given by Thompson, being 55·5 to 185 by 44·4 to 151·7, 33·3 to 88·8 by 7·4 to 16·6, and 11·1 to 20·3 by 3·7 to 7·4 μ, respectively. Monospore cultures of *M. populorum* on potato dextrose agar gave rise to the typical pycnidia and pycnospores of *S. musiva*, inoculations with which on Lombardy poplar, *P. laurifolia*, and Arnaldo Mussolini stems and branches produced characteristic cankers.

Loustalot (A. J.), Burrows (F. W.), Gilbert (S. G.), & Nason (A.). **Effect of copper and zinc deficiencies on photosynthetic activity of the foliage of young Tung trees.**—*Plant Physiol.*, xx, 2, pp. 283–288, 1945.

The authors' investigations showed that copper and zinc deficiencies were definitely associated with a reduced rate of apparent photosynthesis in leaves of young tung trees [*Aleurites fordii*: *R.A.M.*, xxiii, p. 463], less in the case of zinc deficiency than in that of copper; even leaves on deficient plants which appeared normal showed a highly significant reduction in carbon dioxide assimilation.

Zaprometov (N. G.). Болезни Шелковицы. [Mulberry diseases.]—State Publishing Department, Tashkent, 76 pp., 22 figs., 1945.

This work is an enlarged edition of the author's handbook under the same title, published in 1937 [*R.A.M.*, xvi, p. 785], and his list of recognized mulberry diseases

in Russia has been expanded from 23 in the older work to 39 in the present volume; but new work on mulberry powdery mildew (*Phyllactinia suffulta* f. *moricola* Jacz.) [cf. *P. corylea*: loc. cit.; cf. also ibid., xix, p. 549] is reported.

Powdery mildew is one of the most widespread diseases of the mulberry leaf, with a geographical distribution embracing Italy, Japan, India, Indo-China, Burma, Tanganyika Territory, Madagascar, Mozambique, Formosa, Manchuria, China, Iceland, and the United States.

In addition, two other mildews are recorded, *Uncinula geniculata*, widely prevalent in eastern United States, and *U. mori*, found in Japan.

P. suffulta f. *moricola* attacks the under side of the leaf and the two others the upper side. Examination of collections made in Tashkent, Ferghana, the Samarkand provinces of Uzbekistan, Southern Kirghizia and the Leninabadsk province of Northern Tadjikistan showed that the sole agent was this fungus. It is believed also to be prevalent in Afghanistan and Persia. The mildew overwinters in the perithecial stage on fallen leaves and on the shoots. They usually mature at the end of July or August in the following year. Control measures recommended include the improvement of plant sanitation and cultural methods and spraying with sulphate of lime solution early in spring.

Other fungi and diseases recorded include *Bacterium mori*, *Bact. tumefaciens*, *Cylindrosporium maculans*, *C. moricola*, *Armillaria mellea*, *Rosellinia necatrix*, *Sclerotinia sclerotiorum*, *Botrytis cinerea*, *Steganosporium sirakoffii*, a virus disease, 'nitevidnost', causing filiform malformation of the leaves, mosaic, and mosaic with leaf curl.

JØRSTAD (I.) & ROLL-HANSEN (F.). **Melding om sykdommer på skogtraer i årene 1936–1941.** [Report on forest tree diseases in the years 1936–1941.]—25 pp., Oslo, Nasjonal Samlings Rikstrykkeri, 1943. [Received September, 1945.]

The following are some of the observations, besides those already noticed from other sources, presented in this report on Norwegian forest tree diseases from 1936 to 1941 [cf. *R.A.M.*, xv, p. 618]. The aecidial stage of *Pucciniastrum padi* was very prevalent and sometimes destructive on spruce cones [ibid., xx, p. 1] in a number of localities. The alternate (uredo-teleuto) phases of the rust were found on sweet cherries and plums only in the east of the country where spruces are plentiful; the bird cherry [*Prunus padus*], on the other hand, is also attacked in the north and west, with their sparse population of spruces. *P. virginiana* was observed in one locality in 1939 to bear teleutospores of the rust, whilst *P. mahaleb* in another, apparently wild, a new host for Norway, only showed uredospores.

Notes are given on a number of virulent outbreaks of *Chrysomyxa abietis* on spruce [loc. cit.], which extended its northerly range to 69° 35′ N. The rust was also detected on *Picea pungens* and *P. engelmanni*.

Nursery spruces are not infrequently killed during snowy weather by a fungus with a grey to dark-coloured mycelium reminiscent of *Herpotrichia nigra* [ibid., xxiii, p. 49], which may either be sterile or give rise to pycnidia of different types. For instance, those on one-year-old trees in a Telemark nursery in 1928 contained hyaline, unicellular, straight or slightly curved conidia, 3·5 to 5 by 1·3 to 1·6 μ, while in two-year-old material received from Ullensaker in 1939 the conidiophores were better defined, the conidia smaller (3·5 by 1 μ), and the mycelium more hyaline than usual in specimens of this type. Finally, the fungus which was responsible for the death of a whole batch of two-year-old trees in transit from a southern to an eastern nursery was characterized by a greyish mycelium, more slender than the foregoing.

The basidial stage (*Corticium vagum*) [*C. solani*] of *Rhizoctonia solani* was also found on nursery spruces, this being the first record of its occurrence on conifers in Norway.

Polyporus tomentosus [ibid., xxi, p. 174], a very rare fungus in the country, was observed in 1941 in a mixed spruce and hardwood forest; the fruit bodies were growing directly on the ground, and there is some doubt whether the organism is implicated in the rotting of spruces, though its var. *circinatus* [loc. cit.] was found on living trees in 1938.

Melampsora pinitorqua [ibid., xv, p. 618] is by no means common, but on the other hand it may be observed year after year heavily infecting young pines growing in the midst of a large aspen population.

There appear to be two races of the noxious pine rust, *Cronartium flaccidum* [ibid., xv, p. 617], in the country, of which the more prevalent, *Peridermium pini*, occurs solely in the aecidial stage, passing from pine to pine, while the other (*P. cornui*) forms its uredo-teleuto stage on peony and *Cynanchium vincetoxicum*. The latter, heteroecious form being found only in the extreme south-east of the country, *P. pini* is presumably responsible for the bulk of the damage to pines in other parts.

The uredo-teleuto stage of another heteroecious pine rust, *Coleosporium campanulae* [ibid., xxiii, p. 156], was observed in various southern localities on a number of *Campanula* spp., *Euphrasia*, *Melampyrum pratense*, *M. sylvaticum*, *Senecio vulgaris* and other *S.* spp., *Sonchus arvensis*, *S. asper*, *S. oleraceus*, *Petasites hybridus*, and *Tussilago farfara*, the connexion with the aecidial phase on pine being in most cases obligatory.

Pestalotia hartigii, mentioned in the senior author's 1935 report as the agent of needle discoloration in pines [in 1934: ibid., xv, p. 618], again occurred in the same very unusual form in 1937 at a distance of a few hundred metres from the first affected tree, which had been felled in the meantime.

A study of *Polyporus* [*Fomes*] *annosus* conducted during the period under review showed the fungus to be fairly widespread in the east of Norway, though less so than in the west, where its ravages are well known. The affected species, in addition to the ordinary Scots pine [*Pinus sylvestris*], were *P. cembra*, *P. contorta* var. *latifolia*, mountain pine, and scrub pine. The fungus is transmissible from pine to spruce and vice versa, as well as between conifers and non-coniferous hosts, e.g., birch, black crowberry [*Empetrum nigrum*], heather [*Calluna vulgaris*], and bilberry.

Douglas firs [*Pseudotsuga taxifolia*] were first observed to be infected by *Rhabdocline pseudotsugae* in 1939, and an investigation in 1941 revealed the presence of this dangerous parasite in a number of localities in Rogaland and Hordaland. In this connexion mention may be made of an Order of the Department of Agriculture, dated 31st January, 1941, and becoming immediately operative, prohibiting the importation into Norway of plants or parts thereof (except seed) of (1) Douglas fir, (2) Weymouth [white] pine (*Pinus strobus*), and (3) any species of *Thuja*, with the object of preventing the introduction or extension of *R. pseudotsugae* and *Phaeocryptopus gaeumanni* (not yet reported from the country) on (1), *Cronartium ribicola* on (2), and *Didymascella thujina* [ibid., xvi, pp. 86, 299] on (3). The last-named was detected, for the first time in Norway, on *T. occidentalis* in 1939, and in 1941 it was again observed on the same species and *T. plicata*.

Birch rust (*Melampsoridium betulae*) [*M. betulinum*: ibid., xxi, p. 243], though very prevalent, does not normally cause extensive damage, but in certain seasons, notably those characterized by a wet early summer and warm, damp late summer weather, it occurs in epidemic form during the latter period, imparting a yellow-brown tinge to the foliage over wide areas and inducing premature leaf-shedding. Of the years covered by the report, 1937 was conspicuous for the virulence of the disease, while considerable damage was also reported from some localities in 1936.

Gnomoniella alniella Karst. was found producing large, grey-white lesions with irregular margins on alder leaves as far north as Ankenes.

In the autumn of 1940 *Botryodiplodia hypodermia* (Sacc.) Petr. caused an elm wilt simulating that due to *Ceratostomella ulmi*. The former organism is not an active parasite, and the branches, some of which also harboured *Thyrostroma compactum* [ibid., xx, p. 609], had presumably been weakened by another agency.

JØRSTAD (I.). **Uredinales of northern Norway.**—*Skr. norske VidenskAkad.* 6, 145 pp., 1940.

The author describes in this monograph 115 species of rusts known in northern Norway (north of 65°) [cf. *R.A.M.*, xi, p. 675] and a historical summary of collections is given. Of the species recorded *Chrysomyxa abietis* and *Pucciniastrum padi* are occasionally epidemic on spruce [see preceding abstract], and *Sorbus* [*Pyrus*] *aucuparia* is often seriously attacked by *Gymnosporangium juniperi*. *Puccinia coronata*, *P. graminis*, and *Uromyces fabae* are rare.

TINT (H.). **Studies in the Fusarium damping-off of conifers. III. Relation of temperature and sunlight to the pathogenicity of Fusarium.**—*Phytopathology*, xxxv, 7, pp. 498–510, 4 figs., 4 graphs, 1945.

Continuing his studies at the University of Pennsylvania, Philadelphia, on the damping-off of conifers caused by *Fusarium* spp. [*R.A.M.*, xxiv, p. 481], the author tested the relation of temperature variations to the disease and to the growth of the hosts and pathogens in a specially devised apparatus consisting of separate chambers in which air temperatures fluctuated about means at five different levels [see above, p. 6].

A temperature of about 25° C. promoted optimum growth in *F. oxysporum* on potato dextrose agar adjusted to P_H 6 in Petri dishes, while growth was slight at 31·5° and least in the chamber held at 10·4°. The percentage of emergence of *Pinus resinosa* in quartz sand cultures inoculated with the fungus ranged from 0 at 31·5° to 14 at 10·4°, with a maximum of 52 at 16·4°, the corresponding figures at the same three temperatures in the controls being 24, 12, and 70, respectively. Increase in emergence losses and post-emergence damping-off in this species was directly correlated with rising temperatures, both phases of the disease being relatively innocuous at an average temperature of 10°, irrespective of the amount of inoculum. These data suggest the existence of a critical temperature between 10° and 16° below which *P. resinosa* may grow and escape infection by the otherwise deleterious *F. oxysporum*.

Damping-off losses in *P. resinosa* and *P. sylvestris* bore a direct relation to decreasing light intensities, the maximum final stands being obtained in full light. The development of infection in the shaded pots was correlated with the increase in succulence of the hosts and in the growth of *F. oxysporum*, *F. vasinfectum*, and *F. avenaceum* with diminishing light intensities.

ELLIS (D. E.) & GILL (L. S.). **A new Rhabdogloeum associated with Rhabdocline pseudotsugae in the Southwest.**—*Mycologia*, xxxvii, 3, pp. 326–332, 2 figs., 1945.

In May, 1939, a disease of one-year-old Douglas fir needles, apparently the same as the needle blight caused by *Rhabdocline pseudotsugae*, was observed near Safford, Arizona. The affected needles showed the presence of an imperfect fungus resembling *Rhabdogloeum pseudotsugae*, the conidial state of *Rhabdocline pseudotsugae*. Needles collected from the same trees a month later bore fruits of *R. pseudotsugae* as well as the imperfect fungus.

In January, 1940, a needle blight also resembling the disease caused by *Rhabdocline* was noted on needles of 1939 origin on young Douglas firs near Cloudcroft, New Mexico. No fungus was observed fruiting, but needles from several trees when placed in moist chambers and kept in the laboratory developed acervuli

on the lower surfaces within one week. A collection from the same trees in March showed the same imperfect fungus. Needles from this material kept in a moist chamber at 15° to 17° C. for a month developed mature fruits of *Rhabdocline*. This test was repeated on several occasions in spring, and the imperfect fungus was invariably followed by the perfect one. Additional collections from the same locality made in March, April, and May showed a progressive increase in the abundance of the imperfect fungus until May, when *Rhabdocline* appeared in nature with the conidial form.

The conidial fungus was successfully grown in culture, the conidia resembling those produced in nature, but being more constricted in the middle in cultures three or four weeks old. They often became two-celled at maturity, and strikingly resembled the ascospores of *Rhabdocline*. In old cultures, they were often thick-walled and dark. In septate spores, one cell often turned dark, while the other remained hyaline. The conidia generally produced one germ-tube, though two-celled spores sometimes produced two. Germination of both hyaline and coloured spores was noted.

The imperfect fungus somewhat resembles *Rhabdogloeum pseudotsugae*, but the spores are smaller, the conidiophores longer, and the underlying hyphal layer is thicker and more conspicuous. Fruiting bodies were present on both sides of the needle in the type collection of *R. pseudotsugae* examined, but on the upper surface only in a Californian collection, whereas in the authors' material fruiting was chiefly on the lower, and only occasionally on the upper, surface. In the authors' opinion, therefore, the conidial form associated with *Rhabdocline* in the Southwest is not *Rhabdogloeum pseudotsugae*. Since its connexion with *Rhabdocline* has not been proved it is regarded as a new species of *Rhabdogloeum* and is named *R. hypophyllum* n.sp. The acervuli are described as hypophyllous, rarely epiphyllous, in reddish-brown, conspicuous spots, scattered or confluent, often in parallel series on either side of the midrib, measuring 130 to 500 μ wide by 35 to 150 μ high. The hyaline, continuous, oblong, straight to slightly curved conidia, often somewhat constricted near the middle, measure 6·7 to 11·1 by 2·2 to 3·7 μ. The slender, simple, continuous or septate conidiophores measure 10 to 56 by 0·9 to 2·8 μ.

The evidence presented strongly suggests that *R. hypophyllum* (but not *R. pseudotsugae*) is a stage in the life-history of *Rhabdocline pseudotsugae*.

Heim (R.). **Les champignons destructeurs du bois dans les habitations.** [Wood-destroying fungi in houses.]—*Circ. Inst. tech. Bot. Trav. publ.*, Sér. H, 1, 27 pp., 23 figs., 1942. [Received September, 1945.]

In this paper, delivered as an address in Paris on 15th April, 1942, the author, after a brief historical introduction, gives full notes in a semi-popular style on a number of wood-destroying fungi, their characters, habitat, geographical distribution, the type of decay they induce, and their prevention and control. The organisms dealt with include *Gyrophana lacrymans* (syn. *Merulius lacrymans*), *Coniophora cerebella* (syn. *C. puteana*), *Poria vaillantii*, *P. xantha* [*R.A.M.*, xix, p. 573], *P. mucida* (syn. *P. vaporaria*) [ibid., xxii, p. 335; xxiii, p. 506], *Phellinus megaloporus* (syn. *P. cryptarum*, *Poria megalopora*) [ibid., xvi, p. 3], *Trametes serialis*, *Leptoporus ruboflavus* (*Polyporus braunii*) [ibid., xx, p. 505], *Lenzites sepiaria*, and *L. abietina*. The text is accompanied by very clear photographs, and there is a bibliography of 31 titles.

Banerjee (S.) & Bakshi (B. K.). **Studies in the biology of wood-rotting fungi of Bengal.**—*J. Indian bot. Soc.*, xxiv, 2, pp. 73–93, 3 pl., 24 figs., 1945.

The authors present the results of studies of six species of Bengal Polyporaceae [*R.A.M.*, xxiii, p. 157], namely, *Polyporus brumalis*, *P. friabilis*, *P. rubidus*,

P. ochroleucus, *Polystictus steinheilianus*, and *Merulius similis*, giving their geographical distribution, the hosts on which they have been recorded, their cultural characters, including habit of growth, colour, rate of growth, sporophore production, and mycelial characters, with some general conclusions on several external factors affecting the vegetative growth and fruit body formation of these fungi in artificial cultures.

HEPTING (G. H.). **Decay and staining of Southern Pine pulpwood.**—*Paper Ind.*, xxvii, 3, pp. 379–382, 4 figs., 1945.

This is a discussion, based on the published work of the author and others, of the effects of fungal decay and blue stain on the quality of southern pine [*Pinus* spp.] pulp. Where immediate utilization of the wood is impracticable, the damage from these sources may be reduced by storage during the winter months under conditions permitting of rapid drying.

YOUNG (R. S.) & PINKNEY (E. T.). **Determination of sodium fluosilicate in timber preserving solutions.**—*J. S. Afr. chem. Inst.*, xxviii, 1, pp. 10–11, 1945.

Sodium fluosilicate is frequently added to zinc sulphate and similar solutions used as timber preservatives in Northern Rhodesia, and its content should be periodically checked to maintain a concentration toxic to wood-destroying organisms—usually in the ratio of 0·5 per cent. to 5 per cent. sulphate. A special procedure for testing the concentration is described.

VERRALL (A. F.) & HARTLEY (C.). **Lumber shipped green should be protected.**—*Sth. Lumberm.*, clxx, 2131, p. 52, 1945.

Decay of wood in service can often be traced to the use of green or partially seasoned stock that became infected during storage. In Mississippi tests, chlorinated phenate and organic mercurial chemicals, widely used for the control of blue stain in lumber [*R.A.M.*, xxiv, p. 347], protected solid-piled pine stock against both stain and decay for as long as four and sometimes eight weeks. This was accomplished with concentrations of treating solution usually specified for 1-in. lumber. However, for the longer bulking periods a 50 per cent. increase in concentration is recommended. Double-strength solutions gave good results with bulk-piled timbers. It appears possible to reduce the usual treating concentration of these chemicals by up to 50 per cent. or more if 3 to 6 lb. borax are added to each 50 gals. of solution.

MCCOOL (M. M.). **Effect of sodium cyanide on number of fungi, bacteria, and Actinomyces in soil and its value in the control of damping off of seedlings, nematodes, and Cabbage root worm.**—*Contr. Boyce Thompson Inst.*, xiii, 10, pp. 463–472, 1 fig., 1 graph, 1945.

The number of fungi in soil obtained from a vegetable garden was at first reduced by the addition of sodium cyanide at the rate of 250 and 500 parts per million, but the number was increased, as compared with the controls, 28 and 56 days, respectively, after treatment. The total number of bacteria and *Actinomyces* was reduced in two days by the addition of 50 and 100 parts per million, while growth of these organisms was prevented by the addition of 200 and 400 parts per million. The addition of 0·004 gm. or more in solution to dry soil in one-quart Mason jars liberated enough hydrocyanic acid to prevent the growth of *Alternaria* sp. and *Cunninghamella blakesleeana* in tubes of agar placed in the jars. However, when transfers were made to sterilized agar, growth resulted in each case in eight days, except in the case of *C. blakesleeana* from containers to which 0·006 gm. cyanide were added. Six fungi causing seedling damping-off (*Phytophthora* sp., *Pythium* sp., *Rhizoctonia* sp., *Phytophthora* sp., *Alternaria* sp.,

and *Verticillium albo-atrum*) were unable to develop in soil cultures in unsealed containers to which 800 or more parts per million were added; when the containers were sealed for 48 hours, 200 or more parts per million prevented fungal development.

Cultures of *C. blakesleeana*, *Alternaria*, and *Macrosporium* were taken from soil treated with different amounts of sodium cyanide, and growth of each organism took place after they had been in the soil treated with 150 and 200 parts per million for 6, 24, and 48 hours, but when they had been exposed to the treatment for 96 hours, no growth was noted six days after transfer to sterilized agar.

Damping-off of cabbage and pea seedlings was partially controlled by the addition of 200 and 300 parts per million of sodium cyanide to the soil when the containers remained sealed for 48 hours after the salt was mixed with the soil. When sodium cyanide was placed in rows beneath cabbage seed at the rates of 0·06, 0·09, 0·12, and 0·15 gm. per linear ft., damping-off was partially controlled, while rates of 0·075, 0·1, and 0·125 gm. per linear ft. partially controlled damping-off of tobacco seedlings.

Ou (S. H.) & Walker (J. C.). **Anthracnose of garden Pea.**—*Phytopathology*, xxxv, 7, pp. 565–570, 1945.

Garden peas in Wisconsin occasionally suffer heavy damage from anthracnose (*Colletotrichum pisi*) [*R.A.M.*, v, p. 69], which was shown by extensive isolation experiments to be usually associated in the brown leaf, stem, and pod lesions with *Ascochyta* spp. In greenhouse inoculation tests with conidial suspensions of *C. pisi* from potato dextrose agar cultures, mostly on the Perfection and Prince of Wales varieties, the stems reacted only by limited infection round needle wounds, while foliar lesions were confined to mature or senescent material and developed most abundantly at higher temperatures (24° and 28° C.), coinciding with the greater rapidity of ageing under warm conditions. Detached pods contracted infection when inoculated in a moist chamber at 20°. The inoculation of stems with a mixture of *Mycosphaerella pinodes* and *C. pisi* spores, or with the latter several days after the former, resulted in the development of lesions typical of anthracnose as it occurs in the field.

The conidia of *C. pisi* were found to germinate readily on the leaves and stems and to form appressoria [ibid., i, p. 282], only a small proportion of which, however, produced hyphae capable of penetrating the leaves, while entry into the stem was not observed. It would appear from these studies that *C. pisi* acts in the main as a secondary pathogen in the field, especially in respect of the prominent stem lesions.

Five out of 1,200 seeds from naturally infected pods yielded *C. pisi*, indicating the possibility of anthracnose transmission through this channel.

Certification of French Bean seed.—*Agric. Gaz. N.S.W.*, lvi, 8, pp. 349–352, 4 figs., 1945.

The purpose of the French Bean Seed Certification Scheme introduced in New South Wales in 1943–44 [cf. *R.A.M.*, xxii, p. 91] is to ensure that seed of approved varieties free from bacterial blight (*Pseudomonas medicaginis* var. *phaseolicola* and *Xanthomonas phaseoli*) and of a high standard of purity shall be available for sowing. Two inspections are made, one at or about flowering time, and one about 14 days before ripening, when a decision is reached as to whether the crop is of the required standard. A crop may be rejected if showing one or more of the following diseases: *P. medicaginis* var. *phaseolicola*, *X. phaseoli*, or anthracnose (*Colletotricham lindemuthianum*). A tolerance of not more than 5 per cent. for mosaic at the final inspection may be allowed, that for other diseases being at the discretion of the inspector.

Diseases of Carrots.—*Agric. Gaz. N.S.W.*, lvi, 7, pp. 295–298, 5 figs., 1945.

The most important and widespread disease of carrots in New South Wales is the virus disease first studied by Stubbs and Grieve in Victoria [*R.A.M.*, xxiv, p. 134]. The distribution of the disease throughout the year appears to follow the presence of the common carrot aphid (*Cavariella aegopodii*), and for this reason, infection is usually most severe in spring sowings made from July onwards. Carrots sown from mid-December until the end of January generally remain healthy and mature normally, but later sowings mostly become infected. Other diseases sometimes responsible for serious losses are leaf blight (*Macrosporium* [*Alternaria*] *carotae*) [ibid., xxiii, p. 420], leaf spot (*Cercospora carotae*) [loc. cit.], bacterial blight (*Xanthomonas carotae*) [ibid., xxiii, p. 423], root rots due to *Sclerotinia* [*sclerotiorum*: ibid., xxiii, pp. 250, 429], *Sclerotium rolfsii* [ibid., xx, p. 195], and other organisms, and damping-off [ibid., xviii, p. 440; xix, p. 519]. Control measures against these diseases are indicated. Where the virus disease is present, the Osborne Park variety, or selections from it, should be grown.

Ellis (D. E.) & Todd (F. A.). **Control of Lettuce damping-off.**—*Spec. Circ. N.C. agric. Exp. Sta.* 4, 7 pp., 3 figs., 1945.

Owing to the prevalence of lettuce damping-off [*R.A.M.*, xx, p. 242] in North Carolina growers have had to seed two to four times as much plant bed area as they actually need. Post-emergence damping-off, which is more serious than the pre-emergence form of the disease, is due mainly to *Rhizoctonia* [*Corticium solani*], though *Pythium* [? *debaryanum*] is sometimes found in the early stages, and *Sclerotinia* [*sclerotiorum*] is occasionally present. Control consists in seed treatment (against the pre-emergence form) with spergon or cuprocide, the adoption of good cultural practices, including adequate soil drainage, exposure to sunlight, and planting thinly, and treatment of the beds with fermate drench. The first application should be made as soon as the plants are up, and further treatments given at 10- to 14-day intervals throughout the plant-bed season, i.e., five to eight applications are required. The fermate powder should be mixed with water at the rate of $\frac{1}{2}$ lb. per 50 gals., and the mixture applied at the rate of $\frac{1}{2}$ gal. per sq. yd.

Wiant (J. S.). **Mycosphaerella black rot of Cucurbits.**—*J. agric. Res.*, lxxi, 5, pp. 193–213, 7 figs., 1945.

This paper describes an investigation begun at the Market Pathology Laboratory of the U.S. Department of Agriculture, New York, in 1938 and continued until 1942 into a black rot of cucumbers from Puerto Rico [*R.A.M.*, xx, p. 565] and Cuba, caused by the fungus *Mycosphaerella citrullina*, which has also attacked balsam pear (*Momordica charantia*), chayote (*Sechium edule*), Chinese preserving melon (*Benincasa hispida*), Yellow Crookneck squash, and watermelon, all from Cuba, chayote from Jamaica and Puerto Rico, and muskmelon presumably from Venezuela. The decay was also observed twice on domestic Hubbard squash from Virginia and Massachusetts, but it was not found during this particular investigation on domestic watermelon.

The first symptoms on cucumber fruits are small, dark, greasy or water-soaked spots anywhere on the surface of the fruits, roughly circular with well-defined margins, or of irregular shape with indefinite margins. Often a gummy exudate develops at the centre of the lesion and forms a firm deposit when dry. If the colour changes are not marked and the gummy exudate is prominent, the disease may be taken for bacterial spot caused by *Pseudomonas lacrymans*; while larger, darker spots, where no exudate has formed, are similar to early lesions of bacterial soft rot (*Erwinia carotovora*). The most important symptom at the later stages of decay is the blackish discoloration of the affected areas that first develops at

the point of inoculation. Blackening of the lesions is accompanied by a drying-out of diseased tissues, with consequent shrivelling and wrinkling of the cucumber. Unless secondary bacterial decay sets in, the entire fruit becomes a shrivelled black mummy.

Mature pycnidia, brownish at first and subepidermal, are found five days after inoculation on cucumbers held at 70° to 75° F. Pycnidia originating in the mesophyll just below the palisade layer are nearly spherical, and their diameter varies from 109 to 160 μ. The conidia emerge in long, gelatinous horns and are hyaline, either non- or uni-, rarely biseptate, with rounded heads, somewhat constricted at the septa. Measurements of conidia were as follows: non-septate 4·6 to 11 by 2·8 to 5·5 (average 7·7 by 4·0) μ; uniseptate 7·3 to 14·7 by 2·8 to 5·5 (10·3 by 4·4) μ; biseptate 12·8 to 19·3 by 4·1 to 5·5 (15·4 by 4·5) μ.

The numerous nearly spherical to slightly elongated perithecia, with single papillate ostioles and rather heavy, nearly black walls, vary greatly in size; their average diameter was 89 μ. The asci tend to remain joined together at the base, and are clavate-cylindrical to cylindrical, without paraphyses, averaging 52·3 by 10·1 μ with a usual range of 44·3 to 76·1 by 8·9 to 10·6 μ.

The pathogen grows most rapidly in culture at 65° to 85°, optimum 80°. No growth occurred at 95° and it was markedly reduced at 45°. None occurred at 35° in six weeks. Decay of cucumber fruits was very slow at 45° but increased rapidly at 50° to 55°.

Field control through seed treatment and spraying, care in picking and packing to avoid mechanical injury, prompt handling after picking, pre-cooling at 50° or rather lower, and maintenance of temperatures of 40° to 45° during transit are the measures suggested for reducing market losses, particularly for Puerto Rico and Cuban cucumbers.

WHITAKER (T. W.) & PRYOR (D. E.). **The reaction of 21 species in the Cucurbitaceae to artificial infection with Cantaloupe powdery mildew (Erysiphe cichoracearum DC.).**—*Phytopathology*, xxxv, 7, pp. 533–534, 1945.

At the United States Horticultural Field Station, La Jolla, California, 21 species of 11 genera of Cucurbitaceae were inoculated with *Erysiphe cichoracearum*, which has constituted a grave threat to the south-western cantaloupe industry since 1926 [*R.A.M.*, xxii, p. 193]. The reactions of seven species were characterized by a high level of resistance, namely, watermelon, *Cucumis anguria*, *Cyclanthera explodens*, *C. pedata*, *Ecballium elaterium*, *Luffa acutangula*, and *L. aegyptiaca*. Three native species were susceptible, viz., *Cucurbita foetidissima*, *C. palmata* (both of which have been found infected in the wild state and may be a source of infection for cultivated plants), and *Echinocystis macrocarpa*. No species nearly related to the cantaloupe was found to possess a higher degree of resistance to powdery mildew than the cantaloupe itself, and the probabilities of successful hybridization with the virtually immune but only distantly connected members of the Cucurbitaceae are considered to be remote.

CHESTER (K. S.). **Prevention of Watermelon diseases.**—*Mimeogr. Circ. Okla. agric. Exp. Sta.* 133, 2 pp., 1945.

In 1944, when an average of 44 per cent. of the Oklahoma watermelon crop was infected by anthracnose [*Colletotrichum lagenarium*], the cost of the disease to growers was estimated at $80,000. Prophylactic measures should include seed disinfection with semesan, arasan, spergon, or cuprocide; spraying the vines with Bordeaux mixture 3–6–50 or dusting them with 20–80 copper-lime dust, the first applications being made when the plants begin to run and two or more subsequent treatments at 10- to 14-day intervals; and crop rotation where practicable.

Wilt or stem rot [*Fusarium bulbigenum* var. *niveum*] is another major disease which sometimes results in the total loss of stands. It is controllable solely by the use of resistant varieties, of which the most suitable for the State are Hawklee, Blacklee, Improved Kleckley Sweet No. 6, and Hawkesbury Wilt Resistant.

Stem-end rot [? *Diplodia* spp.], the agent of decay both in the field and in transit, is preventable by field sanitation, careful handling, and disinfectant treatment of the cut skins. The development of infection in transit may be reduced by the insertion into a fresh cut in the skin, just before loading, of a disinfectant paste, which may be obtained ready for use on the market or prepared at home by cooking together $3\frac{1}{2}$ qts. water, 8 oz. copper sulphate, and 8 oz. starch mixed with 1 pint water.

Heim (R.). **La culture familiale des champignons alimentaires. Ses possibilités actuelles.** [The domestic cultivation of edible fungi. Its present possibilities.] —Reprinted from *C.R. Acad. Agric. Fr.*, 8 pp., 1941. [Received September, 1945.]

Brief, practical notes are given on the domestic cultivation of edible mushrooms, including *Psalliota campestris*, *Volvaria volvacea*, *Pholiota aegerita*, and morels [*Morchella* spp.].

Price (W. C.), Williams (R. C.), & Wyckoff (R. W. G.). **The electron micrography of crystalline plant viruses.**—*Science*, N.S., cii, 2646, pp. 277–278, 1 fig., 1945.

Electron micrographs of ultracentrifugally purified viruses of tomato bushy stunt [*R.A.M.*, xviii, p. 143], tobacco necrosis [ibid., xviii, p. 348] and southern bean mosaic [ibid., xxiv, p. 132], produced by the authors with the aid of metal shadow casting [ibid., xxiv, p. 434], are considered greatly to assist the electron microscopic study of elementary particles of viruses [ibid., xxiv, p. 265]. In a typical photograph of southern bean-mosaic virus, magnified 58,000 times, the particles were seen to be mostly packed densely in ordered array. In some places the arrangement of the particles was only one layer deep and may be described as a two-dimensional crystal, and at other points the ordered layers are superimposed one above the other to produce the three-dimensional regularity characteristic of true crystallinity. Other photographs disclose greater regularity in the disposition of the particles as the number of layers increased. Well-defined crystal faces and edges have developed on the thicker preparations.

In the case of the bushy-stunt virus the particles tended to cover the entire substratum before forming into three-dimensional patterns, and their two-dimensional patterns exhibited a higher symmetry than that shown by the bean-mosaic virus.

Neuweiler (E.). **Pflanzenschutz.** [Plant protection.]—*Ex* **Bericht über die Tätigkeit der Eidg. Landwirtschaftlichen Versuchsanstalt Zürich-Oerlikon für die Jahre 1938 bis 1942.** [Report on the work of the Federal Agricultural Experiment Station Zürich-Oerlikon for the years 1938 to 1942.]—*Annu. agric. Suisse*, xlv, pp. 404–414, 1944.

During the period covered by this report [cf. *R.A.M.*, xx, p. 4], 23 cases of potato wart (*Synchytrium endobioticum*) were investigated, of which 16 occurred in 1940; most of the outbreaks were on the sites of earlier foci of infection. Since the original detection of the disease in Switzerland in 1925 [ibid., v, p. 124], its presence has been confirmed in 161 municipalities. The fungus has been held in check by the

conversion of infested areas into meadowland and the cultivation of immune varieties.

The best control of potato late blight (*Phytophthora*) [*infestans*] was given by 2 per cent. Bordeaux mixture, but in view of the prevailing copper shortage the admixture of 0·5 per cent. lime-sulphur with the former preparation at 1 or 1·5 per cent. is recommended, while other effective combinations included 0·5 per cent. Bordeaux mixture with either 0·5 per cent. magnesium sulphate, 1 per cent. tannin extract AF b (J. R. Geigy AG., Basle), or 0·5 per cent. and copper Sandoz [ibid., xxiii, p. 91].

Rhizoctonia [*Corticium*] *solani* interfered with the emergence of potato seedlings [ibid., xxiii, p. 405] in cold spring weather; hoeing and manuring promote the rapid development of the host and so help to counteract the effect of the pathogen.

Immersion in a number of German seed disinfectant preparations [which are specified] effectively combated wheat bunt [*Tilletia caries* and *T. foetida*]. Betanal (Schering) at a dosage of 8 gm. per 100 gm. seed-clusters) gave satisfactory control of beet root rot (*Phoma betae*).

A table is given showing the diseases and pests observed in each of the four years comprised in the report, from which it may be noted that bacterial ring rot (*Bacillus* [*Corynebacterium*] *sepedonicum*) was present on potatoes throughout the period.

WITTE (H.). **Redogörelse för verksamheten vid Statens centrala Frökontrollanstalt under tiden 1/7/1942–30/6/1943.** [Report on the work of the State Seed Testing Station for the period from 1st July, 1942 to 30th June, 1943.]—*Medd. Frökontrollanst. Stockh., 1944*, 19, pp. 3–73, 1944. [English summary.]

The following items of phytopathological interest occur in this report [cf. *R.A.M.*, xxiii, p. 127]. Loose smut of brome grass (*Ustilago bromivora*) [ibid., xxii, p. 361] was present in eight out of 159 samples, and *Tilletia decipiens* on creeping bunt [*Agrostis stolonifera*: ibid., xvii, p. 825] in seven out of 33.

Of 21,970 different untreated cereal seed-grain samples analysed for *Fusarium* contamination, an average of 60·3 per cent. was clean, the corresponding figures for very slight, slight, heavy, and very heavy infection being 19·4, 11, 5·6, and 3·2 per cent., respectively; the species attacking rye [*Calonectria graminicola*] was notably prevalent.

Ascochyta pisi was prevalent in pea samples, especially those of the sugar and marrowfat types (67 and 42 per cent., respectively), and occasionally infected dwarf beans. *Macrosporium commune* [? *Pleospora herbarum*] was also detected in bean seed.

Under the potato certification scheme the maximum incidence of virus diseases permitted was 5 per cent., of which leaf roll, streak [potato virus Y], and severe mosaic should not exceed 2 per cent. Of 582 fields examined from this standpoint, 373 (64 per cent.) were approved.

Annual Report, Cawthron Institute, Nelson, New Zealand, 1944–5.—31 pp., [1945.]

In the sections of this report (pp. 14–23) dealing with research on fruit, tomatoes, and tobacco in New Zealand during the period under review [cf. *R.A.M.*, xxiv, p. 6], it is stated that the Cox's Orange and Sturmer apple trees at Tasman and Braemar treated with magnesium-containing compounds in 1939–40 and 1940–1 have steadily improved, benefit being particularly marked on the trees treated in both seasons. Dolomite, particularly when applied at the rate of 12 lb. per tree in one season or 6 lb. in two, consistently gave more enduring benefit than magnesium carbonate and much more than magnesium sulphate, applied at equivalent magnesium contents.

Tomato cloud [loc. cit.] was widely prevalent on outdoor crops. The condition was again ascertained to be associated with heavy watering, and was much reduced where the normal watering programme was restricted.

Inspection of the seedling-beds of 12 tobacco-growers in the Dovedale, Stanley Brook, and Pangatotara areas showed slight to moderate infection by angular leaf spot [*Pseudomonas angulata*: loc. cit.] in four cases. Arrangements were made for the affected beds to be sprayed with Bordeaux mixture. A field inspection of 53 tobacco-gardens in different parts of the tobacco-growing areas made subsequently showed a rather wide distribution of the disease in the Riwaka and Motueka districts, though the Dovedale and Stanley Brook areas were comparatively unaffected.

Experimental evidence gave some indication that both formalin and urea reduce mosaic in tobacco seedling-beds. Heavy nitrogenous manuring of the seedling-beds again increased the prevalence of mosaic. Milk and tannin sprays conferred a high degree of immunity on seedlings where a mosaic-virus spray was applied later.

BERTUS (L. S.). **Plant pathology.**—*Adm. Rep. Dir. Agr. Ceylon, 1943*, p. D 5, 1945.

In this report [cf. *R.A.M.*, xxiii, p. 165] it is stated that in June and July, 1943, *Helminthosporium oryzae* [*Ophiobolus miyabeanus*] caused epidemic infection of rice in the Uva district of Ceylon, where it has not previously been serious. The four months' varieties, Hondarawala, Suduwi, Karayal, Rathkunda, Samba, Perillanel, and Vellai Illankalayan were all equally affected. The outbreak appears to have been favoured by exceptionally humid weather, the presence of the fungus in appreciable amount, and the poor condition of some of the plants.

The young citrus trees affected by exanthema [loc. cit.] were treated by draining and pruning, with and without the application of lime, copper sulphate, or cattle manure. After one year, no treatment had had any appreciable effect.

RICHARDSON (A. S.). **Annual Report on the Department of Agriculture, Uganda, for the period 1st July, 1943–30th June, 1944.**—10 pp., 1945.

In the section of this report [cf. *R.A.M.*, xix, p. 646] dealing with work on cotton and food crops (pp. 6, 7), it is stated that the development by genetic methods of cotton strains resistant to blackarm [*Xanthomonas malvacearum*: ibid., xxii, p. 304; xxiv, p. 449] was continued at Kawanda and Serere. In district trials, the strongly resistant B. 181 cotton gave the heaviest yields in the Eastern Province, notably in Usuku, where it proved in every way superior to the local variety, S.P. 84. In north-west Uganda, S. 2103, a mass selection from N. 17, outyielded B. 181.

The cassava mosaic [ibid., xxii, p. 7] elimination trials were continued at Serere, and the formal testing of resistant clones for agricultural characters, taste, and keeping qualities was begun. The resistant clones were also grown for observation at 11 substations in different parts of Uganda. Mosaic resistance was well maintained under very severe conditions, and the information so far available justifies the issue of seven varieties for provisional multiplication. Brown streak disease of cassava [ibid., xxiv, p. 442] was found in Uganda by Dr. Storey and Mr. Nichols of Amani.

Potato blight (*Phytophthora infestans*) caused no trouble during the period under review. Work at Kawanda in the presence of the other common diseases indicated that the local blue potato (probably Skerry Blue) is the most productive variety under these conditions. It stores, however, for an even shorter period than the average Uganda potato.

Evidence obtained at Serere showed that groundnuts should be sown at the earliest date at which there is a reasonable prospect of securing a good stand without re-sowing, i.e., about the second week in March. Later sowings are increasingly affected by rosette, and give much smaller yields.

Rapport annuel pour l'exercice 1939. [Annual report for the year 1939.]—*Publ. Inst. nat. Étud. agron. Congo belge* (hors sér.), 301 pp., 1 graph, 2 maps, 1941. Fr. 35. [Received November, 1945.]

In the section of this report (pp. 43–47) dealing with plant diseases at Yangambi and Bambesa, Belgian Congo, during the period under review [cf. *R.A.M.*, xxiii, p. 431], R. STEYAERT mentions that oil palms in the former locality showed a trunk infection apparently due to a *Fusarium*, while *Hevea* rubber was attacked by *Rigidoporus microporus* [*Fomes lignosus*]. At Bambesa, further work strikingly confirmed earlier results obtained in the selection of cotton strains resistant to stigmatomycosis [*Nematospora coryli* and *N. gossypii*: ibid., xviii, p. 797]. In conformity with the regulations governing the export of cotton seed outside the Bambesa area, 1,500 plants were marked out for seed production, and of these 22 were found to be affected with wilt (*Fusarium vasinfectum* [loc. cit.] and *Verticillium dahliae*). The disease is becoming progressively worse locally. Whereas over 1,000 cases were found in 1938–9, in 1939–40 the figure, up to November, was nearly 10,000. In the cotton-growing areas of the Uele the whole of the district east of a line joining Bafwasende, Poko, Niangava, and a point on the Sudanese frontier between Dungu and Bafuka must be regarded as infected. To the west of this line, there are infection centres of *F. vasinfectum* at Bambesa and of *V. dahliae* in the Plantation at Dangabu and Dingila.

Sweet potatoes at N'dele in the Ituri district were affected by a condition apparently due to a virus [cf. ibid., xxiv, p. 117].

FAWCETT (G. L.). **Departamento de Botánica y Fitopatología.** *Ex* **Memoria anual del año 1943.** [Department of Botany and Phytopathology. *Ex* Annual Report for the year 1943.]—*Rev. industr. agríc. Tucumán*, xxxiv, 7–12, pp. 149–151, 1944.

During the period under review [cf. *R.A.M.*, xxiii, p. 253], *Frankliniella paucispinosa*, the insect vector of tobacco 'corcova' [tomato spotted wilt virus: ibid., xx, p. 501; xxiv, p. 477] was detected on the flowers of various common plants, including *Medicago lupulina*, *M. hispida*, and *Melilotus alba*, and it is also a constant visitor to the Solanaceae, e.g., *Cestrum* and *Nicotiana* spp.

The only sugar-cane variety at present sustaining economic damage from smut (*Ustilago scitaminea*) [ibid., xxiv, p. 338] is P.O.J. 36, but the disease has occasionally assumed a severe form on Tuc. 472 and Tuc. 1376, the cultivation of which will probably have to be discontinued.

The chestnut-coloured leaf spot of cotton caused by *Verticillium albo-atrum* [ibid., xxiii, p. 254] is most prevalent in low-lying, heavily irrigated soils, and spares none of the many varieties grown at the Tucumán Agricultural Experiment Station.

D'OLIVEIRA (MARIA DE L.). **Doenças bacterianas das plantas em Portugal. I – 'Pé negro' e 'podridões úmidas'.** [Bacterial diseases of plants in Portugal. I—'Black leg' and 'wet rots'.]—*Agron. lusit.*, v, 3, pp. 227–240, 1943. [Received October, 1945.]

A tabulated account is given of comparative studies on the morphological and biochemical characters, pathogenicity, and host range of ten bacterial isolates from the following sources: two from potato plants suffering from black leg [*Erwinia phytophthora*], one in Essex, England, and the other at Moita, Portugal, where the disease causes heavy losses from time to time; two from turnips affected by wet rot, one at Cambridge and the other in Portugal; one from the interior of a celery plant with wet rot on the Cambridge market; one from cabbage at Cambridge with the central portion of the head, bases of the petioles, and medullary tissues of the stem rotten, damp, and malodorous; one from kale in a Lisbon park with wet rot of the stem and petiole bases; one from vegetable marrow fruits in a field near Cambridge,

where wet rot is prevalent; one from melons in a Lisbon park which developed a very watery spot soon after storage; and one from broad beans, with wet rot of the stems in the same locality.

On potato agar the isolates from all the above-mentioned hosts were mutually indistinguishable in shape and colour. They consisted of cylindrical, highly mobile cells with more or less rounded ends, occurring mostly singly but occasionally in pairs or exceptionally in short chains, measuring 0·9 by 0·4 to 1·2 by 0·7 μ when separate or 1·5 by 0·4 to 2 by 0·7 μ in couples, provided with a variable number of peritrichiate flagella, generally 2 to 5, Gram-negative, and non-acid-resistant. The colonies are luxuriant, white, sometimes turning cream-coloured, smooth, and transparent. On potato dextrose agar the growth of the Essex potato strain was yellow or chestnut and that of the Cambridge cabbage isolate pale or deeper yellow. A greenish pigment secreted by the vegetable marrow isolate on this substratum was lost on transplanting to nutrient agar. On meat broth agar the colonies are more scanty, compact, dirty white, and smooth. All the isolates liquefy gelatine, the Essex potato strain being the most active in this respect, and all coagulate milk and reduce litmus.

Turning to biochemical characters, certain differences are apparent between the several isolates, but no relationship was found to exist between the origin of a strain and its reactions. For instance, the fermentations of maltose by the potato black-leg isolates was the only consistent character differentiating them from the soft-rot isolates. Of the two former, one produced gas on all carbohydrates except maltose and the other failed to produce gas on a single one, whilst one of the two strains from cabbage formed gas but not the other.

In cross-inoculation experiments the Essex potato isolate attacked Portuguese cabbage, cauliflower, turnip, vegetable marrow, melon (very slightly), carrot, radish, tomato, *Schizanthus pinnatus*, and *Nicandra physaloides*; the English turnip strain was pathogenic to the same plants (more so to melon than the foregoing) and also to cucumber; the celery and vegetable marrow isolates caused little or no damage to any of the other plants tested; the Cambridge cabbage strain infected all except broad bean and celery; the Portuguese potato isolate was more or less pathogenic to all except celery and cucumber; that from Portuguese kale and turnip attacked all except celery, which in fact was susceptible only to its own strain; the melon isolate infected potatoes (the tubers very slightly), vegetable marrow, carrot, and cucumber (very slightly); and the broad bean was pathogenic to potato stems, vegetable marrow (very slightly), and melon (fruits only partially involved).

Petersen (H. I.). **Afsvampningens Omfang i Danmark.** [The extent of fungicidal treatment in Denmark.]—Reprinted from *Lolland-Falsters Landbrugstid., 1945*, 34, 2 pp., 1945.

The following are among the data presented in this tabulated survey of the statistics of cereal seed-grain disinfection in Denmark in the autumn of 1943 and the spring of 1944. The percentages of farms on which treated seed was used in the islands (comprising Zealand, Bornholm, Lolland-Falster, and Fünen), Jutland, and the country as a whole were 77·8, 65·8, and 70·2, respectively. In general, the practice was more widely adopted on the larger farms than on the smaller ones. Only 14·1 per cent. of the farmers included in the investigation carried out the treatment exclusively at home, 72·7 per cent. entrusted the work entirely to seed-cleansing installations, while 13·2 per cent. made use of both methods. The proportion of seed-grain submitted to treatment over the entire country was 66·3 per cent., the figures for the individual crops being 94·1 per cent. for wheat, 51·4 for rye, 83·1 for barley, 62 for oats, and 50·1 for mixed seed. Dusting was employed by the great majority (92 per cent.) of the seed-cleansing plants, while farmers in general (70 per cent.) preferred liquid treatments. Mercurial preparations have

almost entirely superseded copper sulphate and formalin and were used by 99·3 per cent. of the commercial establishments interrogated.

Barducci (T. B.). **El Trigo 'Maria Escobar' y posibilidades de su cultivo en los Valles Centrales de la Costa.** [The Wheat 'Maria Escobar' and possibilities of its cultivation in the central coastal valleys.]—*Bol. Estac. exp. agríc., Lima*, 25, 34 pp., 23 figs., 1 diag., 1 graph, 1 map, 1944.

Black stem rust of wheat (*Puccinia graminis*) occurs exclusively in the teleutospore phase in the coastal regions of Peru [*R.A.M.*, xxiii, p. 334], where barberry, the aecidial host, is absent. Hence, the physiologic races of the rust in these localities, viz., 48, 189 [ibid., xxii, p. 57], 14, and 15 (the two last-named recently determined by V. A. Revilla), remain reasonably constant. The Maria Escobar variety (38 M.A. × San Martin 28), which has been resistant to the rust in tests extending over 13 years in and around Lima, gave a moderately resistant to moderately susceptible reaction in inoculation trials with race 15 in 1944. However, considering that the conditions normally prevailing in the field are unlikely to be as conducive to infection as those artificially fostered for experimental purposes, Maria Escobar may probably be safely grown in the Lima district if sown before the critical period for attack, i.e., the end of October.

Oort (A. J. P.). **De verspreiding van de sporen van Tarwestuifbrand (Ustilago tritici) door de lucht.** [The dissemination of Wheat loose smut (*Ustilago tritici*) spores through the air.]—*Tijdschr. PlZiekt.*, xlvi, 1–2, pp. 1–18, 3 diags., 1940. [English summary. Received November, 1945.]

A tabulated account is given of experiments carried out in Holland, at Sprundel and Wageningen, to ascertain the reason for the abnormally heavy increase of wheat loose smut (*Ustilago tritici*) [*R.A.M.*, xxii, p. 246] even in crops approved by field inspection for sowing seed and therefore containing not more than six diseased plants per 100 sq. m. At Sprundel, hot water-treated Juliana seed was sown at a distance of at least 2 km. from other wheat fields, a plot of heavily inoculated seed serving as inoculum, while at Wageningen, disinfected Vilmorin 27 seed was sown along two sides of a field in which loose-smut experiments were in progress. In both places the spores spread from the source of infection to the edge of the experimental areas, but at Sprundel dissemination was very markedly in a south-east direction and even at a distance of 70 m. 11 smutted heads per 100 sq. m. were counted, while at Wageningen, where dissemination was more general, 1 to 3 per 100 sq. m. were present 50 to 90 m. away from the origin of infection.

When strong winds are blowing, notably from the south-east and east, the dissemination of the spores is heavy and uniform, pointing to their conveyance on a horizontal plane, whereas light and moderate winds tend to cause an erratic mode of spread, presumably through the action of vertical air currents, so that smutted 'islands' alternate with healthy ones.

In view of these observations, inspectors are advised to reckon with the possibility of the spread of loose-smut over a radius of a few hundred metres in all directions at flowering time.

Poehlman (J. M.). **A simple method of inoculating Barley with loose smut.**—*Phytopathology*, xxxv, 8, 640–644, 1945.

A simplified procedure for the inoculation of barley with loose smut (*Ustilago nuda*), possessing various advantages over M. B. Moore's [*R.A.M.*, xv, p. 567], has been successfully applied at the Department of Field Crops, University of Missouri, Columbia. It consists in the injection into each floret of a spike, by means of a 1 in. 25-gauge hypodermic needle, of a few drops of a chlamydospore suspension from a rubber bulb of 10 c.c. capacity, the operation being performed a day or two after the breaking of the boot. The suspension was prepared from fresh inoculum

obtained from ten winter barley varieties. The fragments of the smutted heads were placed in a cheesecloth square and immersed in tap water, the spores strained through the fabric, and sufficient dextrose added to the suspension to make a 1 per cent. solution. Three heads were used for each variety or selection, and 30 to 40 heads could be inoculated in an hour.

In the C.I. winter barley group, 80 of the 180 selections (44·4 per cent.) contained over 20 per cent. smutted heads, 42 (23·3) over 40 per cent., and 15 (8·3) over 60 per cent., the corresponding figures for 42 standard varieties being 12 (28·6), 7 (16·7), and 1 (1·4), respectively, and for 20 selections of Early Beardless 4 (20), 1 (5), and nil, respectively.

HONECKER (L.). **Erbanalytische Untersuchungen über das Verhalten der Gerste gegenüber verschiedenen physiologischen Rassen des Mehltaues (Erysiphe graminis hordei Marchal).** [Genetico-analytical studies on the reaction of Barley towards different physiologic races of mildew (*Erysiphe graminis hordei* Marchal).]—*Z. PflZücht.*, xxiv, 4, pp. 429–506, 1 fig., 1942. [Abs. in *Plant Breed. Abstr.*, xv, p. 348, 1945.]

Further analytical studies on the hereditary aspect of the reactions of barley varieties to nine physiologic races of mildew (*Erysiphe graminis hordei*) at the Bavarian Plant Breeding Station, Weihenstephan [*R.A.M.*, xx, p. 251; xxiii, p. 11], are fully described and tabulated.

The resistance of Pflugs Intensiv to race A is monomerically determined and semi-dominant; the variety is susceptible to race B. Ragusa b, originating from a Dalmatian land barley, is resistant to both these races, its reaction to B being governed by a single dominant factor, while its resistance to A depends on a different gene from that carried by Pflugs Intensiv.

The resistance of CP 103 21 (a cross between Criewener 403 and Pflugs Intensiv) to race D is incompletely recessive and is determined by the same gene as that conferring resistance to A in Pflugs Intensiv. Neither this gene nor the one responsible for the resistance of Ragusa b to Race B is linked with the *Z* alleles affecting the number of spikelet rows.

The resistance of Ragusa b to A and B is believed to depend on a single major gene *B*, and that of CP 103 21 on a gene *d*. The minor factors *Nek* (necrosis) and *Chl* (chlorosis), hypostatic to *B*, modify the manifestations of resistance in the offspring of Ragusa b. Another modifying gene *n* (necrotic fleck) affects the degree of resistance shown by progenies derived from Ackermanns Isaria, while the use of Palestine C.J. 939 as a parent has led to the recognition of three further modifying factors, P_1, P_2, and P_3, which influence the degree of resistance to races A, B, C, D, and H. Genes controlling resistance were also studied in crosses having Gopal C.J. 1091 as one of the progenitors.

LEUKEL (R. W.) & LIVINGSTON (J. E.). **Smut control in Sorghum and effect of dust fungicides and storage on emergence.**—*Phytopathology*, xxxv, 8, pp. 645–653, 1945.

Further field tests were conducted in 1943 and 1944, mostly in Kansas, Nebraska, and Maryland, to determine the relative efficiency of various fungicidal dusts in the control of sorghum covered kernel smut (*Sphacelotheca sorghi*) and their effects on emergence [*R.A.M.*, xxii, p. 203; xxiii, p. 103]. In Sharon kafir in 1943 emergence was significantly improved by seed treatment with new improved ceresan, copper carbonate, spergon, arasan, Du Bay 1452-C, leytosan, and morpholine thiuram-disulphide, a similar action being exerted on Leoti sorgo by copper carbonate (2 oz. per bush.), arasan (1 and 2 oz.), and Du Bay 1452-C ($\frac{1}{4}$ oz.). On the other hand, emergence in the latter variety was appreciably reduced by new improved ceresan ($\frac{1}{2}$ oz.), Du Bay 1452-C ($\frac{1}{2}$ oz.), merc-o-dust ($\frac{1}{2}$ and $\frac{1}{4}$ oz.), and sulphur (2 and 1 oz.).

Comparable increases were secured in both varieties in 1944 with new improved ceresan, copper carbonate, arasan, spergon, U.S.R. 604 (dichloro naphthoquinone) [ibid., xxiii, p. 265] (1 and 2 oz.), fermate (1 and 2 oz.), zincate (zinc dimethyl dithiocarbamate) [ibid., xxiv, pp. 195, 266] (1 and 2 oz.), and basic copper sulphate (1 and 2 oz.).

In 1943, when the incidence of kernel smut in Sharon and Leoti amounted to only 22·3 and 13·2 per cent., respectively, all the treatments gave reasonably good control of the disease except merc-o-dust, which proved completely ineffectual. In 1944, new improved ceresan ($\frac{1}{2}$ oz.), copper carbonate (1 oz.), spergon (1 oz.), U.S.R. 604 (1 oz.), and basic copper sulphate (2 oz.) reduced the percentage of smutted heads in Sharon from 61·3 to less than 1. In the plots raised from seed treated with 2 oz. arasan, there was 1·1 per cent. infection [ibid., xxiv, p. 187], while zincate, fermate, and sulphur were less effective and 1 oz. arasan failed to control the pathogen. Under conditions promoting severe infection at Wilmington, Delaware, in 1944, only Du Bay 1452-F and new improved ceresan, both at $\frac{1}{2}$ oz., satisfactorily combated *S. sorghi* in Scarborough broomcorn, a variety with persistent glumes, the former reducing the percentage of smutted heads from 75·7 to 2·2 and the latter to nil. Both these preparations gave absolute control of the disease in seven other varieties.

Treated and untreated seed of Club and Sharon kafir, Leoti and Norkan sorgo, and Westland milo was stored at 20° C. and 70 per cent. relative humidity for 180 days, after which period arasan, copper carbonate, and spergon were found to have exerted either a favourable or no effect on germination in steamed soil, while new improved ceresan reduced it significantly in three of the varieties and improved it in one. In unsterilized soil the protective influence of ceresan generally counteracted its harmful tendency, and the other three disinfectants produced a noteworthy improvement. The effects of sulphur, when manifest, were adverse.

PRASAD (N.). **Long smut of Sorghum—method of infection.**—*Curr. Sci.*, xiv, 9, p. 239, 1945.

Long smut of sorghum, caused by *Tolyposporium ehrenbergii* [*R.A.M.*, xviii, p. 517; xix, p. 331] occurs, in India, in Baluchistan, Sind, and Madras. In 1943, it was present in almost every earhead examined in the course of a survey in Sind, the number of grains attacked ranging from 1 to 30. No infection resulted in tests in which spores were mixed with seed before sowing, or with soil, or were dusted on to the flowers, or in which Moore's vacuum method of infection [ibid., xv, p. 567] was used, but positive results were obtained when a few drops of a sporidial suspension were placed in the buds, 90 per cent. of the infected earheads subsequently bearing smutted grains.

Evidently, chlamydospores by themselves have no part in the production of the disease. Presumably, the chlamydospores from the previous crop lie in the soil, germinate, and produce sporidia, which are carried by air to the buds and so produce infection.

KIELY (T. B.). **Diseases of Citrus; spray programmes for coastal growers.**—*Agric. Gaz. N.S.W.*, lvi, 9, pp. 391–394, 4 figs., 1945.

This short, popular note advises coastal growers on spray control measures for protecting citrus crops from black spot (*Phoma citricarpa*), melanose [*Diaporthe citri*: *R.A.M.*, xxii, p. 11], lemon scab [*Elsinoe fawcetti*], exanthema, and sooty blotch.

HEISER (D[OROTHY] G.). **A Nectria disease of Coffee in Western Guatemala.**—*Ann. Mo. bot. Gdn*, xxxii, 3, pp. 287–296, 1 pl., 1945.

Following the rubbing of coffee trees with sacking to remove algae, mosses and lichens, a record harvest was produced in 1935 on the La Soledad plantation in the

San Marcos province of Guatemala. The following year a serious *Nectria* canker disease broke out on the plantation, suggesting that the fungus was already present and was spread by the rubbings. It continues to be noted sporadically throughout the plantation.

The *N.* sp. associated with the disease was studied in material of *Coffea arabica* var. *maragogipes* and deemed to fall within the section *Dialonectria.* It is named *N. dodgei* sp. nov. and is described as follows: perithecia solitary or 2 to 4 aggregate, 140 to 270 μ broad, 160 to 250 μ high, globose or ovoid, smooth, orange; perithecial wall pseudoparenchymatous, about 32 μ thick at the apex and 20 μ at the base, composed of 3 to 5 layers of cells; cells at the apex almost isodiametric, averaging 17 by 15 μ, cells at the base compressed dorsally, averaging 13 by 4 μ; ostiole not papillate, the canal lined with numerous paraphyses; asci about 50 by 5 μ; ascospores hyaline, uniseptate, ellipsoid, not constricted, 7·6 by 3 μ.

The disease occurs usually under good conditions of culture and is characterized by circular or elliptic cankers at the base of the tree. The bark becomes black, the discoloration sometimes reaching as far as the cambium. The blackening extends below the soil and along the tap-root to about 1 ft. below the second laterals. At lower levels the bark appears normal. The outer layers of the bark on the upper laterals show cracking and scaling, with embedded black to dark brown rhizomorphs which change to white as the root becomes smaller. The small rootlets usually remain healthy. The second laterals show white rhizomorphs near the trunk, and little or no infection near the outer ends. The leaves above the canker show irregular mottling at first and then change to greenish-yellow. They are often spotted and usually fall prematurely. There is often some die-back of the twigs as a secondary infection. The fruit is not directly affected, and diseased trees may set a heavy crop the last season before the death of the diseased side.

So far it has proved possible to produce in culture only the imperfect *Fusarium* stage. The aerial mycelium is white, later becoming pinkish or cinnamon-buff on certain media and even grey-vinaceous at the bottom of rice cultures; microconidia straight or allantoid, unicellular, rarely uniseptate, borne in false heads upon simple, occasionally branched conidiophores; macroconidia slightly sickle-shaped, somewhat pedicellate, usually borne in sporodochia. There are no sclerotia or chlamydospores. The conidial measurements are: 0-septate 8·5 by 2 μ, 1-septate 14 by 3 μ, 2-septate 24 by 3·5 μ, 3-septate 34·8 by 3·8 μ, 4-septate 41 by 4 μ, 5-septate 43 by 4·5 μ.

The characteristics distinguishing *N. dodgei* pathologically, physiologically, and morphologically from *N. tropica*, *Hypomyces haematococcus* (*N. anisophila*), and *N. coffeigena*, which are all parasitic on coffee, are described. *N. dodgei* differs from *N. tropica* in its much larger perithecium, measuring 380 to 450 μ, its purple colour, and the radiating, fibrate texture of the perithecia [*R.A.M.*, ix, p. 228]; moreover, the cankers caused by *N. dodgei* are smaller than those induced by *N. tropica.*

Lime-sulphur painted to a height of 3 ft. on the tree trunks, care being taken to see that the solution reaches all the crevices, gave rather more efficient control than Bordeaux mixture.

Inoculations of five-year-old plants of *C. arabica* with a spore suspension of a five-day culture of the *Fusarium* gave inconclusive results, possibly because the variety used differed from that on which the disease was described, or prolonged culture had impaired the virulence of the *Nectria.*

MUSKETT (A. E.) & COLHOUN (J.). **Control of foot rot (Phoma sp.) of Flax.**—*Nature, Lond.*, clvi, 3966, pp. 538–539, 1945.

Further work on the treatment of flax seed with new improved ceresan to prevent foot rot (*Phoma* sp.) [*R.A.M.*, xxiv, p. 230] showed that seed with a moisture content below 10 per cent. when treated with this disinfectant at the rate of 12 oz.

per cwt. and kept for 18 weeks in cwt. lots under ordinary storage conditions gave only 75 per cent. germination, as against 95 per cent. for untreated seed. No effect on germination was noted after eight weeks' storage. Similar treatment with arasan gave no reduction in germination after 18 weeks. When seed with a moisture content of 14 per cent. was treated with new improved ceresan at 12 oz. per cwt. and tests were made in 14 days, germination was reduced to 46 per cent., as against 65 per cent. in the untreated controls. In the treated seeds, a further 23 per cent. gave abnormal growth. It is concluded that it is inadvisable to treat flax seed with new improved ceresan if its moisture content is over 10 per cent. Treated seed with a moisture content of under 10 per cent. should not be stored for more than eight weeks.

Barducci (T. B.). **Producción de semilla de Lino para la costa.** [Production of Flax seed for the coast.]—*Inf. Estac. exp. agríc., Lima*, 58, 12 pp., 1944.

Work is proceeding at the La Molina Agricultural Experiment Station, Lima, Peru, on the development of flax varieties resistant to rust (*Melampsora lini*) [*R.A.M.*, xxiii, p. 334], and among the most promising selections are Nos. 243 to 249, descended from line No. 12–6 of Stormont Cirrus, and Nos. 16 to 33 and 34 to 43, derived, respectively, from lines 1 to 13 and 1 to 18 of J.W.S., all dating from 1942. Highly encouraging results have also been obtained in the development of superior rust-resistant strains of Riga flax by mass selection.

The common practice of procuring seed from the mountains for cultivation in coastal districts has of late been restricted by the discovery of 'pasmo' disease (*Phlyctaena linicola*) [*Sphaerella linorum*: ibid., xxi, p. 352] in the former regions, spreading from the north southwards.

Severin (H. H. P.) & Houston (B. R.). **Curly-top and California Aster yellows diseases of Flax.**—*Phytopathology*, xxxv, 8, pp. 602–606, 4 figs., 1945.

The beet curly-top virus was shown by the senior writer in 1929 to be experimentally transmissible to flax [*R.A.M.*, viii, p. 623], but natural infection (up to 5 per cent.) of the latter was first observed in central California in March, 1944. Early plantings (of the previous October and November) were more severely damaged than later ones, which probably owed their escape to the seasonal migration of the vector of the virus (*Eutettix tenellus*) in the autumn. Moreover, at the critical period for the early-planted flax in 1943, the scanty rainfall limited the feeding areas of the leafhoppers to cultivated crops, of which this was the principal. The symptoms of curly top on flax include irregularity and waviness of the leaves, which are closely grouped at the growing point; gradual chlorosis of the whole plant, mostly followed by death; marked reduction of the inflorescences, and torsion and blistering of the petals, accompanied by failure to expand, desiccation, and eventual wholesale shedding from the ovary; and a pronounced orange-yellow discoloration of the tap-root and crown phloem. Plants infected when a height of 8 to 10 in. has been reached often continue to grow and develop the characteristic foliar symptoms and a coiling of the stem tip; the subsequent branches tend to be deflected from their normal position, resulting in a spreading rather than an erect growth habit. The virus was recovered from naturally infected flax by previously non-viruliferous leafhoppers and transferred to healthy sugar beets, which contracted typical curly-top symptoms.

Flax raised from seed was experimentally infected with the California aster-yellows virus by means of the short-winged aster leafhopper (*Macrosteles divisus*) and a long-winged race of the same species [ibid., xxii, p. 206; xxiii, p. 420]. The first symptom is chlorosis of the apical leaves of the stems, the axils of which give rise to secondary shoots, while further developments comprise floral virescence and proliferation and reduction or absence of petals.

WILSON (M.), NOBLE (MARY), & GRAY (ELIZABETH G.). **The blind seed disease of Rye-grass and its causal fungus.**—*Trans. roy. Soc. Edinb.*, lxi, Part 2 (No. 12), pp. 327–340, 1 pl., 5 figs., 1945. 4*s*.

In this paper, read on 5th July, 1943, the authors, after briefly reviewing earlier investigations into blind seed disease (*Phialea temulenta*) [*R.A.M.*, xxiv, p. 234] of perennial rye grass (*Lolium perenne*), state that in culture on malt agar the conidia usually produce a white, fluffy mycelium, followed by a light to dark chocolate-brown conidial slime, containing an oily substance which gives it an iridiscent appearance, the oily consistency of the slime distinguishing the fungus from *Pullularia pullulans* [ibid., xix, p. 709; xxiv, p. 506]. On germination the ascospores and macroconidia give rise to a mycelium of branched, septate, intertwining hyphae with numerous coils. Within two or three days of germination, macroconidia are produced in succession from the apex of hyphal outgrowths of varying length. They remain clustered round the apex, or become detached and lie against the hyphae, so that they may seem to be budded off directly from many points on the hyphal wall. In culture the conidia are cylindrical, hyaline, have rounded ends, measure 16 to 29 by 3 to 5·3 (usually 21 by 4·3) μ, are straight or slightly allantoid, and contain several, often polar oil globules. Conidial conjugation was frequently observed. In culture and on the host, the microconidia, which occur in pale pink sporodochia on the seed, develop endogenously, being extruded from the terminal portion of unicellular conidiophores; they are unicellular, uninucleate, ovoid, hyaline, contain one oil globule, and measure 3·4 to 4·8 by 2·7 to 3·2 (most frequently 4 by 3) μ. Germination was not observed.

Hansen's dual phenomenon [ibid., xvii, p. 830] was observed in this fungus, isolates of single conidia being of two types, conidial, in which a slime formed, and mycelial, in which there was a growth of white, fluffy mycelium. Microconidia occurred in both types, as did areas of closely packed hyphae. When 10 to 20 single ascospores were isolated from each of a number of apothecia, in many cases all the isolations from a single apothecium were of the same type, either conidial or mycelial, but in some instances approximately equal numbers of cultures of each strain were obtained from the same apothecium. No evidence was obtained of systemic infection of *L. perenne* by the fungus.

Experimental evidence showed that cold, wet conditions favour the disease by prolonging apothecial formation and the pollination and ripening of rye grass and increasing secondary conidial infection. Also, the more often the glumes open before pollination, the more often the ovary is exposed to direct infection by wind-borne ascospores.

Dealing with the histology of infected grain, the authors show that, if the scutellum becomes infected, the seed usually fails to germinate. An endophyte was repeatedly isolated by the authors from the pith of flowering shoots of *L. perenne* and could be distinguished from *Phialea temulenta* within the grain by its finer hyphae and its restriction to the layer immediately outside the aleurone layer, whereas *P. temulenta* has coarser hyphae, and penetrates to any part of the seed. The authors point out that six fungi showing affinities have been recorded on species of *Lolium* and rye, namely, *P. mucosa*, *P. temulenta*, and various *Lolium* endophytes, and all may be perhaps merely strains of one species. In an addendum they state that they fully agree with Neill and Hyde that *P. mucosa* is identical with *P. temulenta* [ibid., xxiv, p. 230]. Heavily infected seed is generally opaque on the diaphonoscope, while slightly infected and healthy seed is usually translucent. The presence of the fungus does not alter the fluorescence, under screened ultra-violet light, caused by the radicles of *L. italicum*, a phenomenon not found in *L. perenne*.

Suggestions for control include the chemical treatment of foundation seed stocks, growing these in drills, and the maintenance of the general health of the crop.

FRICKE (E. F.). **Molybdenum trials on pastures in north-western districts.**—*Tasm. J. Agric.*, xvi, 3, pp. 109–111, 1945.

In further pasture trials carried out in Tasmania in 1944 to test the effect of molybdenum applications on soils where clovers and other legumes do not thrive [*R.A.M.*, xxiv, p. 386], the yields obtained in six localities with (*a*) no treatment, (*b*) 1 cwt. superphosphate per acre, (*c*) 1 cwt. superphosphate + 1 ton lime per acre, (*d*) 1 cwt. superphosphate + 12 lb. ground molybdenite (containing 1 lb. molybdenum) per acre, and (*e*) superphosphate+lime+molybdenite at these rates ranged, respectively, from 55 to 273, 95 to 335, 94 to 439, 116 to 526, and 125 to 464 lb. freshly cut herbage per five plots of 1/140 acre. The data obtained showed that superphosphate increased the yield in every case, lime gave an increase in four out of the six localities, molybdenum increased yield in all six tests, while in three of them the response from 1 lb. per acre was greater than that from one ton of lime, and when both lime and molybdenum were applied, in four areas the yield was greater than when either was applied alone.

THOMAS (K. M.), RAMAKRISHNAN (T. S.), & SRINIVASAN (K. V.). **The natural occurrence of ergot in South India—II.**—*Proc. Indian Acad. Sci.*, Sect. B, xxii, 3, pp. 191–192, 1 pl., 1945.

Further new grass hosts of *Claviceps* in South India [*R.A.M.*, xxiv, p. 369] include *Panicum maximum*, *Themeda cymbaria*, and *Digitaria wallichiana*. The conidial characters of the fungus on the first-named host suggest a connexion with the *Claviceps* on *Cynodon dactylon*, and those of the species on *T. cymbaria* and *D. wallichiana* with the *Claviceps* on *Amphilophis foulkesii* and *D. chinensis*, respectively.

C. viridis, already recorded on *Oplismenus compositus* from the Nilgiris and Kodaikanal [loc. cit.], was found on the same host at Yercaud, 5,000 ft. above sea-level in January, 1945.

MÜLLER (D.). **Über Chlorophyll- und Stickstoffgehalt in Hexenringen von Marasmius oreades.** [The chlorophyll and nitrogen content in fairy rings of *Marasmius oreades*.]—*Friesia*, ii, 4–5, pp. 221–224, 1943.

Evidence is adduced that the chlorophyll content of leaves of *Achillea millefolium* outside the fairy rings caused by *Marasmius oreades* [*R.A.M.*, v, p. 685] amount to 39 to 90 per cent. of that of dark green plants in the rings, while the corresponding figures for the nitrogen content were 51 to 79 per cent. The author observes that *M. oreades* exercises a favourable effect on the growth of some plants as, for example, *A. millefolium*, but affects others adversely.

JOHANSEN (GUDRUN). **Monilinia fructigena (Aderh. & Ruhl.) Honey i Danmark.** [*Monilinia fructigena* (Aderh. & Ruhl.) Honey in Denmark.]—*Friesia*, iii, 2, pp. 111–114, 3 figs., 1945. [English summary.]

The author records the finding in Denmark of apothecia of *Monilinia* [*Sclerotinia*] *fructigena* [*R.A.M.*, xiv, p. 703] on mummified apples, which had been stored in the soil on 9th September, 1936, and remained for twenty months buried. On 18th May, 1938, mature and immature apothecia were found on one mummified apple and during the rest of May and the beginning of June apothecia were discovered on five more, in clusters of from two to eleven. The stalk was ½ to 1 cm. in length, the disk at first cup-, later funnel-shaped, yellow- to grey-brown, 2·5 to 7 mm. in diameter. The asci were cylindrical, 115 to 170 by 7·5 to 11 (average 156 by 10) μ, the paraphyses about 2 μ in width and rather longer than the asci. The ascospores were hyaline, unicellular, ellipsoid, pointed at the ends, 11·0 to 13·2 by 5·7 to 7 (12·2 by 6·5) μ. Apples inoculated with nine different mono-ascospore cultures developed pustules of conidiophores and conidia, the latter measuring on an average 15 to

22·9 by 8·6 to 14 (19·6 by 11·8) μ. Inoculation of young shoots resulted in the formation of cankers. It is considered that the apothecial characters are essentially concordant with those recorded by Aderhold and Ruhland for *S. fructigena*.

ZELLER (S. M.) & MILBRAITH (J. A.). **Transmission of Peach wart to sweet Cherry.** —*Phytopathology*, xxxv, 8, pp. 607–609, 2 figs., 1945.

Peach wart [*R.A.M.*, xxii, p. 213; xxiii, p. 391] was transmitted by budding from Improved Elberta trees in western Oregon to seven peach varieties, namely, Early Crawford, Early Muir, J. H. Hale, Improved Elberta, Orange Cling, Rio Oso Gem, and Rochester, and three of sweet cherry, Napoleon (Royal Anne), Lambert, and Black Republican, five of each being used in all cases except the two last-named, represented by three each. Stem reactions in the Napoleon cherry consist in necrosis of the vascular ring as far as 12 to 15 in. back from the tip, resulting in a general die-back; sometimes excessive branching; shortening and enlargement of the internodes along the last few inches near the branch terminals, which thus acquire a rosetted appearance; and a tendency to reduction in leaf size as a consequence of crowding in the rosettes. The other two cherry varieties responded in a similar manner as regards the stems, but foliar mottling was most conspicuous in Napoleon, reaching a climax in May and June, when ring-like patterns or rectangular bands or lines develop on either side of the veins, and disappearing by late August. The peach-wart virus was also transmitted from the cherry trees back to peach with no apparent attenuation in the former.

SCHNEIDER (H.). **Anatomy of buckskin-diseased Peach and Cherry.**—*Phytopathology*, xxxv, 8, pp. 610–635, 10 figs., 1945.

Sieve-tube necrosis was found to be a feature of peach trees affected by buckskin [peach X-disease virus] in California [*R.A.M.*, xxi, p. 83]. The disorganized sieve-tubes contain wound gum, which gave a positive test with phloroglucinol and hydrochloric acid and reacted negatively or weakly with the Maule reagents for lignin. It was insoluble in a mixture of potassium chlorate and hydrochloric acid and in hot 10 per cent. nitric acid. After the removal of the wound gum by alternate chlorine water and sodium sulphite treatments, the sieve-tubes gave a positive test for cellulose, their previous response having been negative. In young peach shoots showing the early stages of necrotic spotting in the foliage, sieve-tube necrosis was confined to the visibly affected leaves and to the leaf traces below them. With the spread of the virus into the stem tips, necrosis set in also in the sieve-tubes of the youngest leaf primordia that had developed these elements. In the case of resumption of growth after invasion by the virus, the new sieve-tubes usually failed to undergo turgor expansion, lacked thick, crenulated walls with a pearly lustre, and early became necrotic.

Certain strains of the X-disease virus, e.g., one collected in an orchard at Merced, induced stem cankers on very susceptible varieties, such as Phillips Cling. Gum pockets were present in the cortex and phloem of the cankered areas, which were isolated by periderms and sometimes also in the unlignified new xylem. Swollen leaf veins in an infected Muir seedling peach produced an abnormal quantity of secondary phloem, the sieve-tubes of which, as well as those of the primary phloem, soon developed necrosis. Similar effects were induced by ringing of the stem in a Phillips Cling peach tree, and were likewise observed in Palora scions on myrobalan (*Prunus cerasifera*) [*P. divaricata*] rootstocks.

In uninfected young Napoleon sweet cherry trees grown in pots on Mahaleb [*P. mahaleb*] stocks, occasional sieve-tubes on the outer margin of the current year's summer phloem and the non-functioning of previous seasons sometimes contained wound gum, which was also frequently formed in the summer phloem of healthy orchard trees during the autumn. At this period the *P. mahaleb* sieve-tubes were

observed to form callus before those of the sweet cherry. Wound gum was more abundant in the healthy sweet cherry tops than in the *P. mahaleb* stocks, whereas in the case of X-virus-infected trees the position was reversed. In infected cherry scions on *P. mahaleb* stocks wound gum production in the summer phloem was very extensive even at midsummer: eventually the youngest sieve-tubes in the stock, just below the bud union, also became involved. No phloem injury was detected in either healthy or diseased orchard Napoleon cherries on Mazzard [*P. cerasus*] roots, but some wound gum was present in the outer phloem in infected young greenhouse trees on the same stock.

Morris (H. E.) & Afanasiev (M. M.). **Yellows, a non-infectious disease of the Progressive Everbearing Strawberry in Montana.**—*Bull. Mont. agric. Exp. Sta.* 424, 11 pp., 1944.

The non-infectious yellows disease of the Progressive strawberry, which causes a yellow appearance, dwarfing, lower yields, and shorter life, has been the subject of experiments at the Montana Agricultural Experiment Station. The results obtained show that the disease is transmitted through seed, while grafting of healthy Marshall and Blackmore plants on to diseased Progressive plants did not lead to the development of yellows, thus confirming the experience of Berkeley [*R.A.M.*, xi, p. 252], Guba [ibid., xiii, p. 40], Plakidas [ibid., xi, p. 463], and Demaree and Darrow [ibid., xvii, p. 402]. It is concluded that yellows is genetic in character. The use of the 'Montana Progressive' strawberry, produced at the Station, is the only known method of avoiding loss from yellows in the Progressive type of strawberry.

Gilles (E.). **Effet léthal des ondes très courtes sur les microorganismes. Les effets fongicide et bactéricide des ondes très courtes sont, dans certaines conditions, la conséquence d'une action thermique élective.** [The lethal effect of very short waves on micro-organisms. The fungicidal and bactericidal effects of very short waves are, under certain conditions, the consequence of an elective thermal action.]—*C.R. Soc. Biol., Paris*, cxxxviii, 15–16, pp. 545–546, 565–567, 1944.

Details are given of experiments, in progress since 1938, in the exposure of spore suspensions of yeasts and moulds, e.g., *Penicillium*, *Sterigmatocystis* [*Aspergillus*], and *Rhizopus*, in a medium of tap water, to very short waves (1·25 or 1·40 m.), the influence of which proved to be lethal within a very brief period, often of only a few minutes. Important factors in the successful outcome of the tests were a heavy spore concentration and the maintenance of the medium at a high temperature (40° C.), without which sterilization cannot be effected even by lengthy exposures.

Andrade (A. C.). **Ensáio de pulverizadores de costa.** [Appraisal of knapsack sprayers.]—*Biológico*, xi, 8, pp. 201–221, 2 pls., 6 figs., 1 diag., 1 graph, 1945.

A tabulated survey is given of the writer's investigation of the comparative merits for the disinfection of plants of low stature, notably cotton, potatoes, and kitchen-garden crops, in São Paulo, Brazil, of five different types of knapsack sprayers designated by the letters A to E. The factors to be considered in an adjudication between several appliances of this description include pressure, nozzle orifice dimensions and pump capacity, agitation, and efficiency of operation in the field. A pressure of 75 lb. was found to produce a good 'mist' and is to be generally recommended, though it was successfully raised to 100 lb. in a number of tests with sprayer D. The nozzle orifice ($\frac{5}{64}$ in.) and pump (9 mm. in diameter and 7 mm. in height) were also satisfactory. None of the machines could be regarded as perfect, but by a judicious combination of their best features a superior apparatus could be manufactured.

Horsfall (J. G.) & Barratt (R. W.). **An improved grading system for measuring plant diseases.**—Abs. in *Phytopathology*, xxxv, 8, p. 655, 1945.

According to the Weber-Fechner law differentiation by the human eye is regulated by the logarithm of light intensity. Hence, a grading system for the measurement of plant diseases should be based on equal ability to distinguish rather than, as heretofore, on equal amounts of infection. Below 50 per cent. the eye sees the area of diseased tissue; above that point, the healthy tissue stands out. The new rating method is therefore based on 50 per cent. as a mid-point, the grades differing by a factor of two in either direction as follows: 1 = 0, 2 = 0 to 3, 3 = 3 to 6, 4 = 6 to 12, 5 = 12 to 25, 6 = 25 to 50, 7 = 50 to 75, 8 = 75 to 87, 9 = 87 to 94, 10 = 94 to 97, 11 = 97 to 100, 12 = 100. Several plants (20 or more) are graded at random, and the mean grade equals the grade readings divided by the number of readings. A calibration curve is set up with grade numbers on the X-axis and percentage disease on a special semi-logarithmic Y-axis with one and one-half phases from either end up to 50 per cent. The system has already proved useful in research on fungicides, varietal reaction, and the like, and should be of value in plant-disease surveys.

Guba (E. F.) & Seeler (E. V.). **Studies on the identity and control of stilbaceous mold in gas-purifying sponge.**—Abs. in *Phytopathology*, xxxv, 8, p. 655, 1945.

This paper has already been noticed from another source [*R.A.M.*, xxiv, p. 109].

Krassilnikov (N. A.) & Korenyako (A. I.). Мицетин и его Бактерицидные Свойства. [Mycetin and its bactericidal properties.]—*Микробиология* [*Microbiology*], xiv, 2, pp. 80–85, 1945. [English summary.]

A preparation of mycelium derived from *Actinomyces violaceus* [*R.A.M.*, xxii, p. 393] was found to be bactericidal to Gram-positive organisms only and to be more active in synthetic media containing no protein, and less so in meat media. Different strains of staphylococci, streptococci, and mycobacteria are highly susceptible while other strains of the same species may be highly resistant to its action. In mixed cultures the presence of some bacteria appears to protect other, susceptible, organisms from the effect of mycetin.

Ramon (G.) & Richou (R.). **Sur la culture des champignons inférieurs et en particulier du Penicillium notatum sur des milieux formolés.** [On the culture of the lower fungi, and in particular of *Penicillium notatum*, on formolized media.]—*C.R. Acad. Sci., Paris*, ccxx, pp. 265–267, 1945.

The addition to cultures of *Penicillium notatum* on a Czapek-Dox medium of formaldehyde at a dosage of 0·03 to 0·05 per 100 c.c. did not interfere in the least with the vegetative development or spore germination of the mould. Hence, it is suggested that formaldehyde, which is an excellent bactericide but at low concentrations does not inhibit mould growth (as was shown in a series of experiments by the authors over a period of years), may prove valuable as a preventive of extraneous contamination in the industrial production of penicillin.

Gots (J. S.). **The detection of penicillinase-producing properties of micro-organisms.** *Science*, N.S., cii, 2647, p. 309, 1945.

A simple method for rapidly determining the ability of an organism to produce penicillinase is described. To 10 c.c. melted tryptose-phosphate agar at 45° C. 0·1 c.c of a 24-hour broth culture of a strain of *Staphylococcus aureus* sensitive to penicillin is added. Penicillin solution is then added to give final concentrations of 0·5 units per c.c. The plates are poured and allowed to harden at room temperature,

a minimum of surface moisture being necessary. The organism to be studied is then introduced by a single streak, the plates being incubated at 37° for 24 to 48 hours, and inspected for satellite *S.* colonies. If the streaked organism does not produce penicillinase, satellite *S.* colonies do not develop, but if it does produce sufficient penicillinase, then satellite colonies of *S.* occur round the line of the streaked organism. The width of the zone of satellite colonies depends on the amount of penicillinase produced and the concentration of the penicillin in the agar.

Brock (M. C.). **Solvent solutions best for mildew-proofing thread.**—*Text. World*, xcv, 4, p. 141, 1 fig., 1945.

The most effective control of mildew in thread has been obtained by treatment of the warp or skein with copper naphthenate in Stoddard solvent [*R.A.M.*, xxiii, pp. 265, 266; xxiv, p. 200, *et passim*]. Specification JQD 596 (Jefferson Quartermaster Depot), consisting of 8 parts 8 per cent. copper naphthenate to 5 parts spindle oil in a suitable solvent, gives excellent flexibility. Where colour is important, zinc naphthenate may be preferable to copper, which imparts a green colour to the material. A successful method of applying the mildew-proofing agent is to mix it with fibrin wax and run the thread over a hot roll revolving in a wax tank.

Klemme (Dorothea), Greathouse (G. A.), Bollenbacher (Katharina), & Pope (S.). **The deterioration of Cotton fabric by certain micro-organisms.**—*Circ. U.S. Dep. Agric.* 737, 10 pp., 2 figs., 3 graphs, 1945.

Out of 43 fungal isolates studied for their capacity to cause loss of breaking strength in an 8-oz. bleached cotton duck fabric after a week's incubation on a liquid mineral-salt medium with ammonium nitrate as a nitrogen source, 24 were responsible for over 50 per cent. tendering [*R.A.M.*, xxiv, p. 428]. The heaviest reductions were caused by three strains of *Metarrhizium glutinosum* (97, 94, and 84 per cent.), *Stachybotrys atra* (88), *Chaetomium globosum* (86), *Trichoderma* sp. (86), *Thielavia terricola* (81), *Cephalosporium* sp. (81), and *Fusarium oxysporum* (73). The one bacterium, *Spirochaeta cytophaga*, included for comparative purposes, decreased the strength of the fabric by 76 per cent. on the same medium.

Chaetomium globosum, 12 isolates of *Fusarium*, the above-mentioned three of *M. glutinosum*, and *S. cytophaga* were also grown on mineral salts media containing (1) sodium nitrate and (2) ammonium dihydrogen phosphate as nitrogen sources, while a species of *Hormodendrum* was cultured on the former only. In general, the *F.* isolates brought about the maximum amount of deterioration on the ammonium phosphate substratum and the minimum on the sodium nitrate, while those of the other genera and the bacterium were most destructive on the ammonium nitrate nutrient. *C. globosum*, however, proved to be an exception in this respect, causing the most extensive loss on the sodium nitrate medium.

The results of the study indicate a specific relationship between the nutritive reactions of the majority of the organisms utilized and their ability to tender fabrics, within which limitations they are adaptable for experimentation.

Appling (J. W.) & McCoy (J. F.). **Relative toxicity of disinfectants recommended for use in the paper industry. II. Inhibiting concentrations for Bacillus mycoides and Aspergillus niger.**—*Paper Tr. J.*, Tech. Sect., cxxi, 3, pp. 37–40, 1945.

The following were the inhibiting concentrations of ten disinfectants tested against *Aspergillus niger*, an agent of mould in paper and pulp [*R.A.M.*, xxii, pp. 121, 414] in malt agar cultures in Petri dishes after a week's incubation at 30° C. at the Institute of Paper Chemistry, Appleton, Wisconsin: lignasan, 0·0006 to 0·0008 per cent.; merfenel, 0·0001; nalco 21, 0·0120; nalco 21 B, 0·0040; nalco 21 M, 0·0018 to 0·0020; nalco 23, 0·0018 to 0·0020; penetox, 0·0400; permatox 1-S

[cf. ibid., xxiii, p. 507], 0·0016 to 0·0018; P.M. 32 powder, 0·0016; and santobrite [ibid., xxiv, p. 394], 0·0016. The cost toxicity data (inhibiting concentration in p.p.m. × average price per lb. in $) for the several preparations are tabulated as follows: lignasan 2·88, merfenel 11·20, nalco 21 15·60, nalco 21 B 6·60, nalco 21 M 3·42, nalco 23 3·30, penetox 80·00, permatox 1-S 8·00, P.M. 32 powder 12·80, and santobrite 2·40.

VANDERWALLE (R.). **Observations sur l'action de la colchicine et autres substances mito-inhibitrices sur quelques champignons phytopathogènes.** [Observations on the action of colchicin and other mito-inhibiting substances on some phytopathogenic fungi.]—*Bull. Soc. Bot. Belg.*, lxxii, 1, pp. 63–67, 2 figs., 1939. [Received October, 1945.]

Studies on the effect of colchicin, phenylurethane, and acenaphthene on various phytopathogenic fungi [cf. *R.A.M.*, xx, p. 548] are described. From experiments on *Botrytis cinerea*, *Diaporthe perniciosa*, and *Verticillium dahliae* it is concluded that the effect of colchicin (0·2 per cent.) is much less marked on fungi than on higher plants, the concentration necessary to produce the first sign of any action on fungi being at least ten times as great as that required to produce an effect on higher plants. On fungi colchicin appears merely to exercise a toxic effect or to inhibit growth. In tests with etherized solutions of phenylurethane and acenaphthene at 10 per cent. concentration, the former arrested all mycelial development and the latter strongly retarded the germination of *B. cinerea*, which after a few weeks' growth ceased completely. When *Graphium* [*Ceratostomella*] *ulmi* was similarly treated with acenaphthene, conidial germination was rapid, but subsequent development retarded, and the mycelium was thicker than in the control.

MORRIS (H. E.) & AFANASIEV (M. M.). **Potato diseases in Montana and their control.**—*Circ. Mont. agric. Exp. Sta.* 166, 41 pp., 21 figs., 1942. [Received November, 1945.]

This circular deals with the etiology of potato diseases in Montana, seed selection, crop rotation, seed treatment, disinfectants for cutting-knives, sacks, canvas, etc., suberization, storage, potato seed plots, and the various diseases of the potato plant throughout the 35,000 acres planted annually with this crop in the State.

McKAY (R.) & CLINCH (P[HYLLIS] E. M.). **Frost injury simulating virus disease symptoms on Potato foliage.**—*Nature, Lond.*, clvi, 3963, pp. 449–450, 1945.

Following investigations made in Northern Ireland during 1944 and 1945, the authors draw attention to the possibility that widespread mottling of potatoes may not, as the symptoms suggest, be due to mosaic virus disease [*R.A.M.*, vi, p. 634], but to the effect of low temperatures on plants at a stage of development which renders them susceptible to injury; and they submit that, while much of the evidence available is of a circumstantial character, representatives of plants attacked by mottling should be scientifically tested before condemning the stock. The senior author describes strong mottling of Up-to-Date, Kerr's Pink, and Arran Chief potatoes, grown for seed on low-lying, peaty soil in Donegal in 1929 and plainly discernible ten days after a sharp frost on 7th July. The previous history of the crop and the manner in which the mottling developed showed the effect to be due entirely to frost; and the same cause appears assignable to similar symptoms observed on potatoes in Southern and Northern Ireland in July, 1944, after night temperatures of 32° to 35° F. had been registered in Dublin during the last week in June and one or more degrees of frost in the north. An examination of plants grown from these Arran Pilot tubers showed no disease symptoms, and the only virus isolated was a very mild strain of virus X. Following a severe frost on 26th March, 1945, a small shoot of a President plant in a cold greenhouse devoted to the

development of virus-free potatoes at Albert Agricultural College, showed light and green mottling of the leaves, symptoms characteristic of a non-necrotic strain of virus X, but tests showed no virus infection. As the rest of the plant failed to show any disease symptoms up to the time of maturity, the conclusion was drawn that the mottling was caused by low temperatures operating at a critical period of growth, and also in this case by reason of the location of the tip of the affected shoot close to the soil or rim of the pot at that time.

BENZA (J. C.). **Resultados de la experimentación sobre el cultivo de la Papa.** [Results of experimentation on Potato cultivation.]—*Circ. Estac. exp. agríc., Lima*, 62, 89 pp., 1944.

The following information of phytopathological interest occurs in this account of experiments to determine the best methods of potato cultivation in Peru. The virus diseases, mild mosaic [potato virus X], spindle tuber, leaf roll, and rugose mosaic [potato virus Y, frequently in association with potato virus X], are estimated to attack 25 per cent. of the Rímac Valley crops, with a resultant drop in yield of 20 per cent. (or 4,000 kg. per ha.). Fungal diseases in the same area, notably late blight (*Phytophthora infestans*) and wilt (*Fusarium oxysporum* and *F.* [*solani var.*] *eumartii*), are responsible for a 10 per cent. reduction. Seed treatment with formalin (two hours' immersion in a solution of 4 l. in 1,000) is recommended against *Spongospora subterranea* and *Rhizoctonia* [*Corticium*] *solani*, the latter method being also partially effective in the control of rot-producing *Fusarium* spp., but not of the wilt agents. Among the factors contributing to the poor yields of potatoes in Peru are the wide diffusion of diseases and pests, both at high and low altitudes, the absence of protective measures, and inadequate cultural methods.

BALD (J. G.). **The effect of rugose mosaic on the yield of Potatoes.**—*Phytopathology*, xxxv, 8, pp. 585–590, 1 graph, 1945.

In two experiments at Canberra, A.C.T., Australia, leaf areas were measured on Early Carman potato plants infected by rugose mosaic, caused by viruses X and Y [cf. *R.A.M.*, xxiii, pp. 73, 144, 496], and on 'normal' ones harbouring virus X, the final yields also being estimated in both cases. The yield reduction due to virus Y was proportional to the diminution in leaf area measured over a 30-day period after the initiation of tuber formation. The yield of tubers weighing over 2 oz. was reduced by Y infection more than the total output, since the decline in the number of tubers was proportionately less than that of foliar area. For example, in group A in the 1941–2 test, the numbers and weights of tubers below 2 oz. from five rugose mosaic-diseased and ten 'normal' plants were 2·2 and 64 gm. and 1·9 and 72 gm., respectively, the corresponding figures for those above 2 oz. being 1·6 and 115 gm. and 3·1 and 265 gm., respectively, and for the yield per sq. dm. of leaf area 8·8 and 8·7 gm., respectively. In 1942–3 there was again no demonstrable difference in the yield per sq. dm. of leaf area of six 'normal' and two rugose mosaic-diseased plants.

BALD (J. G.) & NORRIS (D. O.). **Virus C from an old Australian variety of Potato.**—*Phytopathology*, xxxv, 8, pp. 591–597, 1 fig., 1945.

A virus isolated from an old Australian potato variety, Brown's River, was identified as virus C [*R.A.M.*, xxiii, p. 404], the physical properties and host range of which ally it closely to virus Y, though it is not ordinarily transmissible by the most efficient vector of the latter virus, *Myzus persicae*. Virus C was inoculated by mechanical means or grafting into 11 other potato varieties, the reactions of which are shown in tabular form. Of the four other Solanaceae inoculated, *Nicotiana glutinosa* gave the most characteristic responses, which included vein-clearing, upward ballooning of the interveinal areas, veinbanding, and loss of colour in the interveinal zones, resulting in mottling, stunting, and severe distortion of the

younger leaves. Similar but milder symptoms were induced by virus Y on *N. glutinosa*, while on Hickory Pryor tobacco the effects of C and Y were almost indistinguishable. *Datura stramonium* reacted negatively to infection by virus C, and on [chilli] pepper the faint mottling, sometimes outlined in pale bronze and accompanied by upward rolling and chlorosis of the leaves, developed only after an incubation period of five weeks. The dilution end point of virus C was between 1 in 10,000 and 1 in 100,000, the thermal death point 61° C., and the period of resistance to ageing *in vitro* between 10 or 11 and 16 days. It is thought unlikely that the virus will spread or cause serious losses.

Potato blights now controllable.—*Food Packer*, xxvi, 7, pp. 68, 70, 1 fig., 1945.

Dithane (disodium ethylene bisdithiocarbamate) [*R.A.M.*, xxiv, p. 195] was first made available commercially by Rohm & Haas, Philadelphia, in the autumn of 1944, and its large-scale use for the control of potato early and late blights [*Alternaria solani* and *Phytophthora infestans*] has hitherto been confined to certain southern regions of the United States. Thus, in the Homestead region of Florida, fields treated with dithane D. 14 yielded as much as 325 to 425 bush. per acre compared with 225 to 275 for those given Bordeaux or other coppers. The value of continuing the treatments until maturity was experimentally demonstrated, an increase of 22·8 bush. per acre, representing a net profit to the grower of $45.56, having been obtained in one trial from an additional (eighth) weekly application. These results were confirmed by the experience of commercial growers, who reported yields of 425 bush. per acre from nine or ten applications as against 350 for seven.

The combination of water-solubility and surface activity in dithane causes the formation of an invisible, unbroken film over the foliage. Unlike the insoluble coppers, the new preparation undergoes no loss of strength through settling out of suspension in the spray tank, nor does it clog the nozzles of the equipment.

Bertrand (H. W. R.). **Treatment of brown bast.**—*Quart. Circ. Ceylon Rubb. Res. Scheme*, xxii, 1–2, pp. 21–22, 1945.

Neither scraping nor stripping of old *Hevea* rubber trees having given satisfactory control of brown bast [*R.A.M.*, xix, p. 165; xxiii, p. 290], the author (for whose views the Rubber Research Board accepts no authority) considered that owing to the more rapid bark renewal of young trees a less drastic method might be better. A new procedure was therefore tested on budded rubber of Tj. 1 and HC. 28 of six to eight years. The panel was isolated by cutting the usual groove through the hard bast and a cut was made in the wood with a sharp, narrow blade. The affected area was lightly scraped, the knife never being allowed to pass into the soft bast. The large but thin traces of brown bast tissue were disinfected next day with 5 per cent. izal and Swedish Red, the whole work being done in fairly dry weather.

The results showed that on one estate of 52 trees treated 13 were cured by one treatment, 32 of the remaining 39 being cured by a second treatment six months later. On a second estate, of 44 trees treated, 34 were cured the first time. The method appears to be economical and effective and also to require less skill than the old, deeper method.

Campbell (W. A.) & Sleeth (B.). **A root rot of Guayule caused by Pythium ultimum.**—*Phytopathology*, xxxv, 8, pp. 636–639, 1 fig., 1945.

Guayule (*Parthenium argentatum*) in California suffers from a root rot due to *Pythium ultimum* [*R.A.M.*, xxiv, p. 287], which falls into two stages, one known as 'seedling root rot' on plants in the cotyledonary phase (a period extending over about four weeks), and the other, termed 'pink rot', affecting those from six weeks to four months old. The former, characterized by slight stunting and a purplish or reddish discoloration of the cotyledons and rotting of the roots at varying depths

in the soil, may be regarded as part of the damping-off complex, while the latter causes the formation of pink lesions, $\frac{1}{8}$ to $\frac{1}{2}$ in. long, on the tap-roots, generally 3 to 6 in. below soil-level. This form of root rot, which is accompanied by wilting of the tops during the heat of the day, may be responsible for severe losses on heavy, poorly drained soil.

Of the 51 isolates studied, 27 produced oospores typical of *P. ultimum* as described by Middleton [ibid., xxii, p. 373] on maize meal agar, while the remaining 24, which formed only sporangia or similar structures, were referred to the same species on the grounds of association with oospore-producing isolates, morphological aspect, and growth rates.

CHOWDHURY (S.). **Diseases of Pan (Piper betle) in Sylhet, Assam. Part V. Sclerotial wilt. Part VI. Gloeosporium leaf-spot.**—*Proc. Indian Acad. Sci.*, Sect. B, xxii, 3, pp. 175–190, 2 pl., 2 graphs, 1945.

Sclerotium rolfsii has been found to cause an annual mortality of 4 to 31 per cent. in the *Piper betle* [*R.A.M.*, xiv, p. 122] plantations of a number of Assam villages [cf. ibid., xxiv, p. 248]. The symptoms induced by the pathogen comprise decay of the stem at soil-level, where a dense, white, cottony mycelial mass is found at the site of entry, and wilting of the aerial organs. Numerous sclerotia develop on the stems and on the soil near the plant bases, while inter- and intracellular hyphae penetrate the tissues and disorganize the middle lamella, where a soft rot consequently develops. The disease appears during the middle or latter part of May and continues to flourish until the first or second week in August, when the incidence of infection begins to decline and the attacks cease in early September.

Inoculation experiments in which the sclerotia were buried 3 or more inches deep in the soil gave negative results, but rapid infection ensued when they were placed on, or an inch below, the surface; at a depth of 2 in. the symptoms were delayed. The incubation period ranged from two to five days, and a high degree of humidity was shown to be essential for infection, while the virulence of the fungus reached a climax at 30° to 35° C. These data are borne out by field observations, which have shown the prevailing temperatures during June and July to approximate to this range and to be accompanied by a relative humidity of 91 to 98 per cent.

In oatmeal agar cultures the mycelium of *S. rolfsii* was killed by three minutes' exposure at 50° and two at 52°, while the sclerotia succumbed after five minutes at 59° and two at 62°. In the laboratory the sclerotia retained their viability for a year, but after 16 months all were dead. In the field they may be buried to a depth of 4 in. in fairly moist soil with little loss of viability, but at 6 in. none was capable of germination after 45 days.

In nature wilt is disseminated by the sclerotia, which are carried on implements, the feet of labourers and animals, drainage water, manure, and soil. Earthing-up the soil in such a way as to cover the sclerotia with a layer over 3 in. deep reduced the mortality from *S. rolfsii* from between 12 and 21 to between 2 and 7 per cent. Prevention of the disease should be based on soil sterilization, preferably by heat, the planting exclusively of healthy setts, and deep ploughing. The heating of the soil may be carried out with a gun emitting a flame of 2,000° F., bringing the temperature to 75° to 82° C. for a depth of 6 in., or failing this contrivance by burning with straw, thatching grass, or some similar material.

A widespread leaf spot of *P. betle*, characterized by irregular, straw-coloured, depressed lesions, usually one to four, rarely covering the surface, was found to be caused by a species of *Gloeosporium* [ibid., xxiii, p. 457] representing the conidial state of *Glomerella cingulata*. The disease, which is of no great importance, is spread by wind and rain, and persists on dead vines and foliage lying in the plantations. It may be combated by clean cultivation, destruction of dead refuse, and spraying the plants with 2–2–50 Bordeaux mixture or perenox.

Heim (R.). **Un Agaric rhizomorphique parasite des semis de Quinquina en Haute-Guinée.** [A rhizomorphic Agaric parasitic on the seedlings of *Cinchona* in Upper Guinea.]—*Rev. Bot. appl.*, xx, 222, pp. 78–87, 2 figs., 1940. [Received September, 1945.]

In April, 1939, the author observed *Cinchona succirubra* and *C. ledgeriana* seedlings in a nursery in Upper Guinea apparently affected by a form of damping-off. The plants wilted and parts of them died when the two first leaves were 4 to 5 mm. long; the affected parts showed the presence of a small agaric, which was evidently responsible for the condition. This fungus produced whitish rhizomorphs, which spread through the soil of the infected beds, and, on approaching roots, gave off hyphae which penetrated into the superficial and deeper tissues of the plants.

The sporophores showed an excessive development of the stipe, which was dirty white, measured up to 22 mm. in height, and lengthened out into a pointed cone up to 3 (occasionally 4) mm. in diameter at the base and 0·7 mm. at the apex. The stipes generally terminated in a pileus which appeared triangular in profile and measured less than 3 (exceptionally 4) mm. in diameter. Under the markedly involuted, dark greyish-blue peridium were about 24 pliciform, strongly decurrent, whitish lamellae which constituted the sterile hymenium. The flesh was whitish and odourless, and continuous from the stipe to the pileus.

From the base of the sporophores, usually isolated, but sometimes connate in twos and threes, spread milky-white, branched rhizomorphs ranging up to 250 μ in diameter and forming a network, with sporophores at the nodes.

The parallel, cylindraceous constituent hyphae of the rhizomorphs measured 3 to 15 μ in diameter, while the thin, sinuous, nodulous, varicose, irregular supporting hyphae measured mostly 2 to 3 μ in diameter. The young hymenium showed basidial, piriform-elongated cells 6 μ broad, without sterigmata or any beginning of sporulation. The fungus was evidently a purely vegetative form, and was unable to develop further. It appeared to belong to *Clitocybe*, and does not seem to have been recorded before.

The control measures recommended consist in the careful removal with forceps of the fungi and rhizomorphs from the frames as soon as they appear, the aeration of the frames, and the partial sterilization of the soil before sowing by means of natural or steam heat, or by the application of 2 to 4 per cent. formaldehyde solution or of ortho-2-4-dinitrophenol.

Stoffels (E. H. J.). **Le Quinquina.** [Cinchona.]—*Publ. Inst. nat. Étude agron. Congo belge, Sér. tech.* 24 a, 57 pp., 26 figs., 1 graph, 1945.

In the section of this publication (which is a second and larger edition of one originally issued in 1939) dealing with fungal diseases of *Cinchona* (pp. 24–25), very brief notes are given on the root diseases due to *Armillaria mellea* [*R.A.M.*, xxiii, p. 431], *Rosellinia arcuata*, *Diplodia* [*Botryodiplodia*: loc. cit.] *theobromae*, and *Helicobasidium* sp. [loc. cit.]; trunk and branch infection by *Corticium salmonicolor* [ibid., xix, p. 330]; trunk infection by *Phytophthora palmivora*; the disease formerly referred to as a tracheomycosis [loc. cit.; ibid., xxiii, p. 431], but now found to cause bark necrosis also; leaf infection by *Phyllostictina* sp., seedling damping-off due to *Rhizoctonia* sp. [loc. cit.], and seedling root disease caused by *Cladosporium herbarum*. [It is not stated whether all these diseases occur in the Belgian Congo or not.]

McM[artin] (A.). **Fungicide experiments on Cane planted under wet conditions.**—*S. Afr. Sug. J.*, xxix, 7, p. 279, 1945.

Before planting in excessively moist soil on 25th January, 1945, the ends of Co. 281 sugar-cane cuttings were dipped in the following fungicidal solutions as a precaution against pineapple disease [*Ceratostomella paradoxa*: *R.A.M.*, xxiv, p. 290]: abavit, ceresan, and agrosan at 1 and 2 per cent., harvesan [ibid., xxiv,

p. 177] at 2 and 4 per cent., and spergon at 6·5, 1·25, and 2·5 per cent. Each plot consisted of 50 four-budded cuttings, and each treatment was replicated six times. On 10th April, when the final counts were made, the number of buds grown out of 1,200 in the plot treated with 1 per cent. abavit was 601 compared with 331 in the control, the increases secured from the remaining treatments ranging from 349 (minimum concentration of spergon) to 556 (2 per cent. agrosan). An examination of the cuttings on 17th April revealed very little pineapple disease, most of the decay being of a general nature in which no single organism predominated. All the treatments, especially the mercurials, gave some degree of control, but abavit 1 per cent. again excelled all the rest, with a total number of shoots amounting to 3,483 compared with 773 in the check plot.

MAYOR (E.). **Contribution à l'étude de la flore mycologique du Valais. La flore mycologique de Val d'Anniviers.** [A contribution to the mycoflora of Valais. The mycoflora of the Val d'Anniviers.]—*Bull. Murith.*, lx, pp. 73–90, 1942–3. [Received November, 1945.]

A list is given, based on a study of the relevant literature and on numerous personal observations made in 1941 and 1942, of the parasitic fungi present in the Val d'Anniviers, canton of Valais, Switzerland. The list comprises Peronosporaceae, Protomycetaceae, Exoascaceae, Erysiphaceae, Ustilaginales, and Uredinales.

MAYOR (E.). **Mélanges mycologiques.** [Miscellaneous mycological notes.]—Reprinted from *Ber. schweiz. bot. Ges.*, liv, 18 pp., 1944. [Received November, 1945.]

Notes are given on the author's investigations in Switzerland into *Milesia kriegeriana* [*R.A.M.*, xv, p. 469], *M. scolopendrii* [ibid., xxi, p. 455], *M. vogesiaca* [ibid., xx, p. 235], *M. polypodii* [ibid., xv, p. 469], *Uromyces poae* Rabh. f. sp. *repentis-trivialis* Juel, *Puccinia baryi*, and *P. ribesii-diversicoloris* [ibid., xix, p. 119].

In the canton of Neuchâtel the pycnidia and aecidia of *M. kriegeriana* form on the current year's needles of *Abies alba*, and never develop on those two years old or more, while the same applies to all the other species of *Milesia* found locally. The aecidia of *M. kriegeriana* were present from 20th July up to 10th October. As in the case of aecidia of other species of *Milesia* present in the canton, they were noted only on young *Abies*, never on large trees, and the younger the trees, the more susceptible they are. Experimental evidence demonstrated that the pycnidia and aecidia of *M. kriegeriana* can develop on *A. alba*, *A. cephalonica*, *A. concolor*, *A. grandis*, *A. nordmanniana*, and *A. pinsapo*, but were observed in nature only on *A. alba*.

M. scolopendrii, found in different parts of Europe on *Phyllitis scolopendrium*, is rather rare in Switzerland, and has been seen by the author only in four places in the canton of Neuchâtel. Experimental evidence showed that the pycnidia and aecidia can develop on *A. alba*, *A. cephalonica*, *A. concolor*, *A. nordmanniana*, and *A. pinsapo*.

M. vogesiaca is found in Switzerland on *Dryopteris lobata* and very rarely *D. lonchitis*. Experimental infections showed that the pycnidia and aecidia can develop on *A. alba*, *A. cephalonica*, *A. nordmanniana*, and *A. pinsapo*.

The pycnidia and aecidia of *M. polypodii* were observed in nature locally only on *A. alba*, but in infection tests they also developed on *A. cephalonica*, *A. concolor*, *A. nordmanniana*, and *A. pinsapo*.

In 1932 and 1933 the author showed experimentally that the pycnidia and aecidia of *P. baryi* develop on barberry [ibid., xiii, p. 655]. In 1935 aecidia were observed at Chaumont-sur-Neuchâtel. From 1940 to 1942 the author observed in four localities aecidia on barberry which resembled those of this fungus. With these, he experimentally infected young seedlings of *Brachypodium silvaticum*, on which uredospores of *P. baryi* later developed.

Infection tests showed that the pycnidia and aecidia of *P. ribesii-diversicoloris* are able to develop on gooseberry, red currant, *Ribes alpinum*, *R. aureum*, *R. petraeum*, and *R. sanguineum*, but not, apparently, on black currant. In nature, so far as the author is aware, they occur only on *R. alpinum* and gooseberry; locally, they are common on the former and rare on the latter.

MAYOR (E.). **Notes mycologiques. XI.** [Mycological notes. XI.]—Reprinted from *Bull. Soc. neuchâtel. Sci. nat.*, lxviii, 16 pp., 1943. [Received November, 1945.]

The following items are selected from this further instalment of the author's mycological studies from 1939 to 1942 in the canton of Neuchâtel, Switzerland [cf. *R.A.M.*, xx, p. 235]. *Plasmopara sphaerosperma* was found on the leaves of *Tragopogon pratensis* in 1933 and 1935. This fungus was previously reported by the author as *Bremia lactucae*, but Săvulescu has expressed the view [ibid., xxiii, p. 120] that the fungi recorded in the literature on *T. dubius* and *T. pratensis* as *B. lactucae* should be referred to *P. sphaerosperma*, a detailed description of which he gives. This fungus appears to be very rare, having been recorded in only two places (Rumania and Italy) on *T. dubius* and in two (Czechoslovakia and Switzerland) on *T. pratensis*. *Microsphaera alphitoides* [*M. quercina*: ibid., viii, p. 411 *et passim*] was found on the leaves of *Quercus robur* var. *pyramidalis* in 1942. *Coleosporium campanulae* [ibid., xxiii, p. 156] was collected on needles of *Pinus nigra* on 11th May, 1939, and early in May, 1940, 1941, and 1942. *Melampsora orchidi-repentis* [*M. repentis*: ibid., xvi, p. 776] was found on several occasions on leaves of *Salix repens*.

BEELI (M.). **Notes mycologiques congolaises. Champignons récoltés dans la région du Kivu par F. L. Hendrickx, mycologue à l'Ineac.** [Mycological notes from the Congo. Fungi collected in the region of Kivu by F. L. Hendrickx, mycologist to Ineac.]—*Bull. Jard. bot. Brux.*, xvi, 1, pp. 105–107, 1940. [Received October, 1945.]

This annotated list of fungi collected in the vicinity of Kivu, Belgian Congo, by F. L. Hendrickx during 1938 and 1939 includes several Polyporaceae.

DA CAMARA (E. DE S.) & DA LUZ (C. G.). **Mycetes aliquot Lusitaniae. VI.** [Some fungi of Portugal. VI.]—*Agron. lusit.*, v, 2, pp. 119–142, 2 pl., 1943. [Received October, 1945.]

This further instalment of the writers' critically annotated list of fungi of Portugal [cf. *R.A.M.*, xxii, p. 409] comprises, besides three new and one doubtful species, 34 hitherto unknown in the country, including *Septoria apii* on celery and *S. saponariae* on *Saponaria officinalis*.

BUCHWALD (N. F.). **Lidt om Hymenoforets variation hos poresvampe og en ny varietet af Daedalea quercina (L.) Pers., D. quercina var. irpiciformis.** [On the variation of the hymenophores of Polyporaceae and a new variety of *Daedalea quercina* (L.) Pers.]—*Friesia*, ii, 2–3, pp. 161–165, 1 fig., 1940–1941. [English summary. Received November, 1945.]

This paper discusses briefly the variations of the hymenophore in Polyporaceae, which are either environmental or more frequently autogenous. A new variety of *Daedalea* [*R.A.M.*, xxiii, p. 158] is described as differing from the normal form in its irpicoidal hymenophore, with coriaceous, membranaceous, compressed teeth, with sharp apices, 5 to 15 mm. long; found on oak trunks in the Nørreskov woods of North Zealand on 7th October, 1934.

BAKER (G[LADYS] E.). **Conidium formation in species of Aspergilli.**—*Mycologia*, xxxvii, 5, pp. 582–600, 64 figs., 1945.

The writer points out that the conidia of *Aspergillus clavatus*, *A. fumigatus*, and *A. repens* are uninucleate and produced from uninucleate phialides; the conidium

of *A. fumigatus* becomes binucleate by mitotic division preceding germination; and that the conidia of the other two species become multinucleate by several mitotic divisions before germination and their spores at germination show great volumetric increase [cf. *R.A.M.*, xxiii, p. 494]. In these species the transfer of a single conidium is presumed to perpetuate a homokaryotic line, but mass spore transfers would enable the process of heterokaryosis to be effected by anastomoses, dependent upon differences existing in the haploid nuclei. It might be expected that heterokaryosis would be increased in the case of *A. repens*, owing to differences among the nuclei arising from karyogamy and meiotic segregation in a homothallic and perithecial species. The conidia of *A. echinulatus* are multinucleate when formed, but the original nuclei entering the conidia divide freely so that before germination the cell may have more than eight nuclei. Transfer of a single conidium may mean the carrying of different characters although there is an equal probability that all nuclei which enter the spore are alike. As *A. echinulatus* is homothallic and perithecial, the effects of karyogamy and meiotic segregation must be taken into account in relation to the nature of the haploid nuclei. Whether the several nuclei of the conidiophore initial cells are homo- or heterokaryotic cannot be determined cytologically, but depending upon this condition, conidia of different chains on the same vesicle may carry like or unlike nuclei.

The conidia of *A. repens* and *A. echinulatus* differ sharply in their nuclear condition, and if both species are good representatives of the *A. glaucus* group, the suggestion that the group as a whole differs cytologically from other *Aspergillus* spp. is untenable.

KRASSILNIKOV (N. A.). О классификации лучистых грибов ACTINOMYCETALES. [The classification of the ray-fungi, Actinomycetales.—*Микробиология* [Microbiology], xiv, 3, pp. 164–171, 1945. [English summary.]

The author claims that the Actinomycetales [*R.A.M.*, xxiii, p. 150] form a distinct group of organisms and include the genera *Proactinomyces*, *Mycobacterium*, *Corynebacterium*, and *Mycococcus*. Diagnostically the group, together with the non-sporing, Gram-positive rods and cocci, may be differentiated from the Gram-negative, and the sporulating, motile, Gram-positive bacteria, and is entitled to consideration as an independent taxonomic unit.

TUNSTALL (A. C.). **Mycological Branch Report for 1944.**—*Rep. Tocklai Exp. Sta. Indian Tea Ass., 1944*, pp. 5–7, [1945].

Sun scorch of young tea plants set out during the rains may be prevented by the protection of the collars from the August and September sun by a bamboo wrapping round the stems, while interplanting with *Boga medeloa* should also prove helpful.

An investigation of the mode of overwintering of the black-rot fungus (*Corticium invisum*) [*R.A.M.*, xv, p. 748; xxi, p. 48] in material collected at the Station, at Borbhetta, and in local gardens, revealed its presence on the branch surfaces from the current season's growth to varying distances between the last pruning-level and the soil, with a maximum of 20 in. The sclerotia, hyaline at first, turning darker later, and of variable shape, were minute, the maximum dimensions observed in November being 263 by 145 μ. They first became visible in the second week of September and did not extend beyond the primary cortex. By the middle of December the rather dark-coloured superficial mycelium connecting the elongated sclerotia was probably dead.

Good control of red rust [*Cephaleuros mycoidea*] was obtained in experiments from 1941 to 1944 by spraying with 0·3 per cent. perenox [ibid., xxi, p. 391], while the beneficial effects of one year's omission of pruning and of leaving an extra leaf above the plucking-level in July and August of each season were also noticeable.

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Manil (P.). **Une virose du Tabac, non encore décrite en Belgique.** [A Tobacco virus not yet described in Belgium.]—*C.R. Soc. Biol., Paris*, cxxxix, 3–4, pp. 185–186, 1945.

At the end of August, 1943, the writer observed on the upper leaves of Samsun tobacco plants at the Gembloux Agronomic Institute necrotic, white spots, frequently perforated, and pursuing a well-defined course along the veins, either immediately beside them or a short distance away. In some cases the entire surface was involved, in others only one side; in the latter event the leaf was twisted. At a second inspection about 15th September, some of the newly developed side shoots bore typical necrotic lesions, while others appeared perfectly normal. Necrotic streaks, 5 to 20 mm. in width, were present on some of the stems. These symptoms were evidently distinct from those of the tobacco-mosaic and [potato] X-viruses, the absence of which from the diseased material was confirmed by inoculation and serological tests. After an incubation period of 12 days, young tobacco and *Nicotiana glutinosa* plants inoculated with the juice of infected individuals developed a mild, somewhat diffuse mosaic, preceded by vein-clearing. The disease presents analogies with J. Johnson's 'tobacco streak' [*R.A.M.*, xv, p. 535].

Köhler (E.). **Untersuchungen und Betrachtungen über Virusantagonismus im Pflanzenkörper (Mittg. 1).** [Studies and reflections on virus antagonism in the plant system (Note 1).]—*Angew. Bot.*, xxv, 5–6, pp. 313–323, 1943. [Received November, 1945.]

In order to determine whether the multiplication of a 'second' virus, introduced into a plant already harbouring a different virus, is effected at the expense of the 'first', the author conducted a series of tests on Samsun tobacco in which the leaves of plants containing the tobacco mosaic virus from the three-leaf stage were inoculated by rubbing, when nearing the time of flowering, with the CsA strain of potato virus X [*R.A.M.*, xvii, p. 264; xxii, p. 109]. The results of the experiments, taken as a whole, indicate that the propagation of the 'second' virus pursues a course wholly, or at any rate largely, independent of the 'first', and thus a categorically negative reply may be returned to the question at issue. At the same time, further support is lent to the hypothesis that the very intensive multiplication of the 'second' alien virus is feasible because its nutritional requirements are different from those of the 'first', and that conversely, on the meeting of two nearly related viruses, the propagation of the 'second' is impeded by the similarity of its demands on the substratum to those of the 'first'.

Stelzner (G.). **Spontaner Befall von Physalis alkekengi L. durch einen besonderen Stamm des Tabakmosaik-Virus.** [Spontaneous infection of *Physalis alkekengi* L. by a special strain of the Tobacco mosaic virus.]—*Angew. Bot.*, xxv, 5–6, pp. 359–368, 9 figs., 1943. [Received November, 1945.]

A plant of the ornamental *Physalis alkekengi* in a German garden was observed in the spring of 1941 to bear conspicuous, white lesions, distributed over the whole

leaf surface and sometimes delimited by the main veins. The smaller veins were in part streaked with green and thus served to divide up the large, white areas into smaller ones. The affected leaves were also more or less wavy. The following year the plant developed the identical symptoms, showing that the infective principle must have survived the winter.

At the Müncheberg (Mark) Plant Breeding Institute inoculation experiments with the juice of diseased plants on *P. alkekengi* and *P. franchetii* resulted in the development of the typical white spotting. Samsun tobacco reacted by an alternating mosaic of normal and well-defined, pale green areas, the latter standing out from a white background; winter infections tended to cause severe foliar malformations, with less prominent mottling, necroses often being formed along the main veins and on the stem which usually killed the whole plant. In *Nicotiana glutinosa*, *N. silvestris*, *Datura stramonium*, and beans (Genfer Markt and Nordstern), primary lesions developed without subsequent systemic infection, a response comparable to that elicited from the same hosts by the tobacco mosaic virus. On Condine Red tomatoes the symptoms were characteristic of the aucuba mosaic strain of the tobacco mosaic virus, with which strain the virus is considered probably identical.

WALKER (E. A.) & MCINROY (ELIZABETH W.). **Tobacco anthracnose, a plant bed and field disease.**—*Phytopathology*, xxxv, 8, pp. 598–601, 2 figs., 1945.

Mention has already been made of the first observation of tobacco anthracnose in Maryland in 1941 [*R.A.M.*, xxi, p. 269]. Besides the species of *Colletotrichum* then reported as the agent of the disease, *Gloeosporium* sp. was isolated from some of the lesions and other strains of the latter organism were obtained from dark sectors in the *Colletotrichum* cultures. Sectoring was abundant in the *Colletotrichum* cultures, while two strains of this species and two of *Gloeosporium* also produced spiral growth. In 1942 the disease assumed a destructive character both in the seed-bed and in the field, the pathogen being presumably conveyed from the former to the latter through the transplanting of infected individuals, on which the original lesions continued to develop in the form of leaf spots, leaf midrib and petiole cankers, and stem cankers. Tobacco anthracnose has been ascribed by Johnson & Valleau (*Plant Dis. Reptr*, xix, p. 144, 1935) to *C. destructivum*, by Averna Saccá to *C. nicotianae* [*R.A.M.*, iii, p. 179], and by Böning to *C. tabacum* [ibid., xi, p. 753], but the fungi associated with the disease in Maryland are not specifically identified.

MATTHEWS (E. D.). **A biochemical study of soil organic matter as related to brown root rot of Tobacco.**—*J. agric. Res.*, lxxi, 7, pp. 315–325, 1945.

This inquiry has been undertaken in order to ascertain what connexion, if any, there may be between the condition of discoloration and decay, symptomatic of brown root rot of tobacco, which is particularly severe in its incidence when tobacco has been preceded by a sod crop, notably timothy [*Phleum pratense*: *R.A.M.*, xviii, p. 634], and the biochemical nature of the crop residues which appear to intensify the disease.

An examination of these residues, chiefly by proximate analyses, suggested that the negative correlation between organic matter and the severity of brown root rot was merely accidental, which seems emphasized by the fact that, although the rot was shown markedly to vary in incidence according to the cover crop which preceded it, the total organic content of the soil remained static. There was no brown root rot on fallow plots, in which the organic content was very low. Brown root rot is most severe when cellulose is added, increasing the organic content of the soil. These facts are held to prove that brown root rot does not increase with decreasing organic matter in the soil, and that its higher intensity where organic matter is low is only a coincidence. Neither total organic nor total nitrogen content in the soil

appear to have any determinant influence on the pathogenicity of brown root rot of tobacco.

Analysis of variance showed that the association between the nitrate-nitrogen fraction and the preceding cover crop was important, and the author considers nitrate nitrogen to be the only soil constituent important *per se* in its direct influence on the severity of the disease; but the effect of nitrate-nitrogen variations is dependent upon that of variations in the carbohydrate: nitrate nitrogen ratio of the soil. This confirms the work of R. C. Thomas (*Res. Bull. Wis. agric. Exp. Sta.* 105, 28 pp., 1930) on nitrate nitrogen and nitrification in relation to the growth of tobacco and brown root rot, but the present experiments suggest that carbohydrate material has less importance for the occurrence and severity of the disease than appeared to that author. The preceding crop appears to affect the following tobacco crop indirectly by influencing the carbohydrate-nitrogen ratio, and more directly by its effect on the nitrate-nitrogen content of the soil.

RICHARDS (M. C.). **The control of Alternaria blight on N. H. Victor Tomatoes by the application of fungicides.**—Abs. in *Phytopathology*, xxxv, 8, p. 656, 1945.

New Hampshire Victor tomato plants were sprayed against *Alternaria* [? *solani*] five times between 20th July and 26th August, 1944, with (*a*) copper oxychloride sulphate at 1, 2, 4, and 8 lb. in 100 gals. [*R.A.M.*, xxii, pp. 82, 328], (*b*) Bordeaux mixture at 1–1–, 2–2–, 4–4–, and 8–8–100, and fermate at ½, 1, 2, and 4 lb. in 100 gals. None of the treatments appreciably increased the total yields, but all resulted in highly significant improvements in the production of marketable fruits, the maximum of 19·8 lb. per plant, compared with 9·4 for the untreated, being effected by fermate 4–100. Equivalent control of the fungus at 88 per cent. defoliation was obtained with fermate 1 in 100, Bordeaux mixture 4–4–100, and copper oxychloride sulphate 9·5 in 100.

Province of Nova Scotia. Report of the Department of Lands and Forests, 1944.—181 pp., 5 maps (1 col.), Halifax, N.S., King's Printer, 1945.

The following items of phytopathological interest occur in this report. Since 1940 a die-back of birches has been increasing throughout the Province, and at present no definite explanation concerning its origin can be given, among the possible causes being insect infestation, fungal infection by *Dermatea molliuscula* (Schw.) Cash in its imperfect stage *Gelatinosporium fulvum* Peck, and adverse physiological factors. It is not unlikely that the die-back may be due to a combination of insect and fungus invasion, similar to that which resulted in the mortality of beeches from the joint attacks of *Cryptococcus fagi* and *Nectria* (?) *coccinea* [*R.A.M.*, xxii, p. 185]. Pending more definite information as to the etiology of the trouble, however, only general recommendations, based on those of V. S. Jensen (*J. For.*, xli, pp. 180–185, [1943]) for the management of hardwood stands, can be made.

Fungal diseases observed during the period under review included a maple [*Acer*] blight, possibly due to *Gloeosporium apocryptum*; balsam fir [*Abies balsamea*] needle blight (*Rehmiellopsis bohemica*) [*R.A.M.*, xix, p. 627; and below, p. 61], of which this is apparently the first record for Canada; and 'red branch' of the same host, associated with *Adelopus balsamicola*, but more likely to have been initiated by *Valsa friesii* [ibid., ix, p. 420].

ROLAND (G.). **Étude faite sur une trachéomycose du Chêne occasionnée par un Diplodia.** [A study made on a tracheomycosis of Oak caused by a *Diplodia*.] —*Parasitica*, i, 1, pp. 11–34, 2 pl., 1945. [Flemish summary.]

This is an expanded account of work on the tracheomycosis of oak (*Diplodia quercina*) in Belgium already noticed from another source [*R.A.M.*, xxiv, p. 390].

Robinson (G. P.) & Sanford (L. W.). **Defects in California Red Fir.**—*J. For.*, xliii, 6, pp. 439–440, 1945.

Considerable interest is being shown in the American lumber market in red fir (*Abies magnifica*) as a potential substitute for other conifers during the scarcity of mixed stands arising out of war conditions. The principal defects observed by the writers in their recent study of logging operations in Sierra County, California, are butt rot [of unspecified fungal origin] and shake. The former condition may extend from a local pocket in the bark near soil-level to 30 or even up to 50 ft. up the tree. The largest 'cat faces' are often accompanied by a purely local rotten area, whereas small, barely perceptible breaks near the ground are likely to indicate extensive progress of the causal organism in an upward direction. The total amount of reduction from butt rot in the particular operations under discussion was 55,000 board ft. out of 805,000 cut, or roughly 7 per cent. Totally worthless trees are few and fairly conspicuous, either by reason of the fruit bodies indicating the spread of the heart rot right along the trunk, or from the sickly appearance of the tree, swellings in the upper bole, dead limbs throughout the crown, and broken tops. *A. magnifica* is stated to be more resistant to decay than all the other true firs [*A.* spp.] and to compare favourably in quality with Douglas fir [*Pseudotsuga taxifolia*].

King (H. C.). **Pine plantations in Mauritius working plan report.**—81 pp., 4 graphs, 1 map, Assistant Conservator of Forests, 1944.

The following items of phytopathological interest occur in this report. Two important fungal parasites have developed in the pine plantations of Mauritius since 1936, one being in all probability *Armillaria mellea*, though positive identification awaits the production of fruit bodies, while the other causes brown rot of the heartwood and root-stock of *Pinus taeda* and is as yet undetermined. *A. mellea* causes the heaviest damage on *P. caribaea*, *P. taeda* being less susceptible and *P. sinensis* almost immune. In 1943 the fungus was observed on a high proportion of the trees (40 per acre) in a dense planting of *P. taeda*, some dominant individuals of which succumbed. *A. mellea* may be kept within bounds by general measures directed towards the stimulation of free growth and hygienic improvement of the stands. Privet (*Ligustrum walkeri*), an underwood favoured on silvicultural grounds, appears to be resistant to the root rot.

Martínez (J. B.). **El Fomes annosus Fr. (Trametes radiciperda Hart.) en España.** [*Fomes annosus* Fr. (*Trametes radiciperda* Hart.) in Spain.]—Reprinted from *An. Jard. bot. Madr.*, iii, 49 pp., 4 pl., 1943. [French, English, and German summaries. Received November, 1945.]

In 1941 the author collected on a pine (*Pinus sylvestris*) stump in the forest of Balsain, Segovia, sporophores which were shown by morphological, histological, and cultural studies to be identical with those of *Fomes annosus*, doubtfully recorded once for Spain by Lacoizqueta (*An. Hist. nat. Madr.*, p. 214, 1885). The fungus was readily isolated on various standard media, of which malt extract agar proved to be the most suitable. Under laboratory conditions the so-called 'conidia of Brefeld', measuring 4·5 to 6 by 3 to 4 μ, were produced. The pathogenesis, development, and control of the rot caused by *F. annosus* are discussed in the light of the relevant literature.

Conard (A.). **Sur Coniophora cerebella et sur les champignons qui se sont associés à lui dans un cas de destruction de planchers.** [On *Coniophora cerebella* and the fungi associated with it in a case of destruction of floors.]—*Bull. Soc. Bot. Belg.*, lxxiii, 1–2, pp. 93–116, 2 pl., 39 figs., 1940–1941. [Received October, 1945.]

The author describes the fungi found on four specimens of rotted floorboards. The principal agent of the decay is believed to be *Coniophora cerebella* [*C. puteana*],

which was represented by a large fructification, black mycelial cordons associated with brown cordons and filaments bearing brown protuberances and showing in places a characteristic shrinkage of their contents, and brownish-red conidia which occurred in tracheids as well as on the surface of the wood. These conidia were spherical, hemispherical, or oval, with their bases invaginated at their insertion on simple, brown filaments, and measured 2·5 to 4·6 by 2·5 to 4·6 μ.

A coremial form was also found which it is thought may possibly represent another spore-form of *C. puteana*. This produced masses of brown, ellipsoid spores, measuring 3·5 to 8 by 2 to 3·5 μ.

Other fungi found on the specimens include a species of *Gymnoascus*, provisionally identified as *G. reessii*, and *Aspergillus* and *Penicillium* spp.

WILFORD (B. H.). **Chemical impregnation of trees and poles for wood preservation.** —*Chemurg. Dig.*, iv, 13, p. 230, 1945.

From 1930 to 1940 tests were carried out in North and South Carolina to determine the applicability to fence posts, utility poles, and similar materials for rustic construction of various methods of sap-stream impregnation, using 58 chemicals and chemical combinations on 1,639 trees and 188 poles.

Copper sulphate and zinc chloride at injection dosages of $\frac{3}{4}$ and 1 lb. to $\frac{1}{2}$ gal. water, respectively, per cu. ft. wood have given satisfactory results as preservatives. Both are cheap, available locally, simple to apply, and easily detected. Copper sulphate discolours wood and corrodes iron, whereas zinc chloride does not stain and is only slightly corrosive. Chromated zinc chloride (a mixture of zinc chloride and sodium dichromate) [cf. *R.A.M.*, xxi, p. 109; xxii, p. 84] can be recommended at a dosage of $\frac{3}{4}$ lb. to $\frac{1}{2}$ gal. water per cu. ft., while sodium arsenite ($\frac{1}{2}:\frac{1}{2}$) is only fairly effective and very poisonous. The poor distribution of the otherwise excellent preservative, mercuric chloride, renders it unsuitable for use by the sap-stream method. Ammonium bifluoride, which has only recently been tested, appears to be comparable to zinc chloride in its preservative properties and allows the wood to dry out more than most of the other salts used. It tends, however, to break down into poisonous compounds. Similar observations have been made in respect of a mixture of copper chloride and arsenic acid, which in limited trials promised to act as a highly efficient preservative, precipitating in the wood as a stable compound repellent to insects and fungal agents of decay. Two other compounds deserving of further tests are zinc meta arsenite and more especially ammonium copper arsenite.

Absorption of the chemical solutions by pines and yellow poplars [*Liriodendron tulipifera*] takes nearly a fortnight. The impregnated woods seem to undergo little checking while seasoning. Pines respond more satisfactorily to sap-stream impregnation, which only reaches the active sapwood, than do hardwoods with their generally less durable heart and transition wood. Late spring and summer treatments are usually the most efficacious.

POUND (G. S.) & WALKER (J. C.). **Differentiation of certain crucifer viruses by the use of temperature and host immunity reactions.**—*J. agric. Res.*, lxxi, 6, pp. 255–278, 10 figs., 1945.

In further studies on the viruses associated with cabbage mosaic [*R.A.M.*, xxiv, p. 438] it was found that they fell into two groups, namely, turnip virus 1 [turnip mosaic virus] group, containing cabbage virus A [loc. cit.] and the cabbage black-ring virus, and cauliflower virus 1 [cauliflower mosaic virus] group containing cabbage virus B [loc. cit.] and the cauliflower mosaic virus. Investigations were undertaken in order to distinguish these groups and strains by differential temperature reactions and by host immunity tests.

The coarse chlorotic mottling with leaf malformation characteristic of both viruses of the former group was found to vary in rate of development and in severity with the air temperature to which the plants were exposed, infection being most acute at 28° C. and mildest at 16° C. In comparison with black-ring virus, virus A showed considerably higher pathogenicity at 28° and 24°, but the reverse was noted at 20° and 16°. In the latter group, symptom intensity increased with decrease in temperature and complete masking occurred at 28° and 24°. Both the viruses of this group induced chlorotic vein-clearing and veinbending.

In the combined attack on cabbage of either virus A or the black-ring virus in conjunction with either virus B or the cauliflower mosaic virus, the subsequent infection was more severe than that produced by either virus alone, and at 28° and 24° assumed the appearance of an entirely different disease. At low temperatures, however, the virulence of virus A or the black-ring virus declined, and the symptoms induced agreed closely with that of virus B or the cauliflower mosaic virus. In such combinations the black-ring virus reacted very similarly to virus A and the cauliflower mosaic virus to virus B; and when the temperature at which plants infected with a virus combination were growing was reversed from high to low, or vice versa, a corresponding recession in symptom type occurred.

On Brussels sprouts, *Nicotiana rustica*, and *N. multivalvis* virus A and the black-ring virus at high temperatures produced practically identical symptoms, but at low temperatures the symptoms differed considerably. The reactions to these viruses of *N. glutinosa* and other hosts provided symptoms similar to those given by Holmes [ibid., xix, p. 229] for his family Annulaceae, while those produced on the same host at 16° were characteristic of Marmoraceae, thus revealing the shortcomings of a system of classification based primarily upon symptomatology.

Cabbage was successfully immunized against black-ring virus by virus A, using the differential reaction between virus A and the black-ring virus on the hosts mentioned above. Similarly, cabbage plants were rendered immune against infection by virus A by the use of black-ring virus, as measured on *Solanum integrifolium*, which was completely differential for virus A.

On hosts such as Chinese cabbage (*Brassica pekinensis*), *B. nigra*, turnip, *B. arvensis*, and *B. campestris* the reaction of the cauliflower mosaic virus was much more severe than that of virus B; and by the use of the differential reaction on *B. pekinensis*, virus B was shown to immunize cabbage against infection by the cauliflower mosaic virus.

BJÖRLING (K.). **Undersökningar rörande Phoma betae (Oud.) Fr. med särskild hänsyn till en av svampen orsakad stjälkröta på Betfröplantor.** [Investigations relating to *Phoma betae* (Oud.) Fr. with special reference to a stem rot of Beet seed plants caused by the fungus.]—*Medd. Växskyddsanst., Stockh.*, 44, 96 pp., 58 figs., 2 graphs, 2 maps, 1945. [German summary.]

Among other serious effects of severe infection by *Phoma betae* on sugar beets in the coastal areas of south and west Scania, Sweden [*R.A.M.*, xix, p. 691], where the pathogen is very prevalent, is a premature ripening of the seed, the quality and quantity of which are both reduced. The external symptoms appear at the end of July or early in August in the form of brown or black necroses, 1 to 25 by 0·5 to 3 cm., mostly confined to the lower third of the stem in the early stages but tending later to coalesce and involve the upper part also. The centres of the necroses, often of a greyish colour, are occupied by the pycnidia of the fungus. In the course of threshing operations large numbers of these bodies are crushed, so that the spores they contain are liberated and invade all the seed-clusters; hence, no doubt, the almost invariable occurrence of infection on the seed.

The growth of the pathogen within the host is markedly perthophytic [feeding on parts of the host that have either been killed in advance by the fungus or

have died from natural causes: ibid., ix, p. 47], and is predominantly restricted to the outer tissues, seldom proceeding beyond the cambium into the xylem of the vascular bundles and medullary tissue.

The great majority of the stem necroses arise through contact with previously infected basal leaves or leaf fragments, which adhere to the stems in wet weather, while the mycelium from diseased leaves may also traverse the petiole and so reach the stem. Furthermore, the beet aphid, *Doralis* [*Aphis*] *fabae*, is a potential vector of infection, but instances of transmission through its agency are rare. Foliar lesions bearing pycnidia are much more common in stands grown for seed than in first-year fields. Observations on the seed plants revealed the sudden appearance of the pathogen in early or mid-July on a large number of individuals simultaneously, strongly suggesting infection by wind-blown spores, in all probability the ascospores of the perfect stage, *Pleospora betae*, described by the author as a new species in *Bot. Notiser*, 1944. Inoculum from this source is available in abundance throughout the growing season, the asci being produced during the winter on the minute fragments of stubble that escape burning after threshing and find their way into the soil, liberating ascospores in the following summer.

Unlike other phases of the beet disease due wholly or in part to *P. betae*, the stem rot is not conspicuously influenced by environmental factors, assuming an equally severe form both in acid and alkaline soils, though definite increases in the incidence of infection were experimentally induced by the addition of nitrogen to the fertilizer and by irrigation, and an equally definite, though smaller, reduction by the use of superphosphate as a soil amendment.

Two new types of vegetative reproduction are described. One is limited to the submerged mycelium and consists of short, quasi-isodiametrical cells with thickened cross walls, which arise at intervals from the strongly pigmented hyphae and on the desiccation of the medium fall into oidioid segments of single cells or short chains. Transferred to a fresh substratum, these elements produce normal colonies. The other growth form is represented by hyaline, mostly spherical, fairly thick-walled chlamydospores, which emerge in dense clumps from intercalary or terminal constrictions on the swollen, profusely branched, coarse aerial hyphae. These organs, transplanted from cultures up to a year old on to a fresh medium, gave rise to a luxuriant mycelium. Aerial mycelium is very rarely formed on the host, but in a moist chamber it develops, together with chlamydospores of the foregoing type, from some at least of the necroses on seed-beet stems.

Inoculations with mono-ascospore cultures of *P. betae* on healthy seed-beet stems resulted in the formation of typical brown, striate necroses containing pycnidia identical with those of *Phoma betae*. In supplementary tests, in which surface-sterilized seed-clusters from healthy plants were inoculated with mycelium from the mono-ascospore cultures, the resultant seedlings contracted the characteristic damping-off associated with *P. betae*. These cultural and pathological observations are regarded as establishing the genetic connexion between *P. betae* and *Pleospora betae*, while the evidence in regard to *Mycosphaerella tabifica* [*R.A.M.*, xiv, p. 282] is stated to be incomplete and unsatisfactory. The following is a brief summary of the development of the ascigerous state. Plectenchymatic stromata are laid down in the subepidermal host tissues in October to November, and from their centres arise ascogenous hyphae with binuclear cells, which in turn produce a succession of asci in a more or less close-knit pseudohymenium: eventually these organs fill the plectenchyma, converted by this time into black, roughly hemispherical pseudothecia (von Höhnel's terminology), measuring 230 to 340 μ in breadth and 160 to 205 μ in height. The pale, yellow-green ascospores, 19·5 to 25 by 8·5 to 10 μ, are usually furnished with three cross walls and the two median cells with one or two longitudinal walls also. They germinate much more rapidly than the pycnospores, in one to two hours in distilled water at 20° or 25° C., generally by means of several

germ-tubes and to the extent of practically 100 per cent. The cardinal temperatures for germination were identical with those of the pycnospores, viz., minimum 0° to 5°, optimum 20° to 25°, and maximum 30° to 35°. After 20 months in the laboratory, 80 per cent. of the ascospores in the dry 'pseudothecia' were still viable.

From a lengthy discussion on morphological and pathogenic variation in *Phoma betae* it appears that numerous biotypes, differing mutually in these respects, may arise either in the process of sexual reproduction or as true mutations, such variants being found, not only in widely separated localities but on different plants, or even on a single plant, in the same seed field.

Turning to the problem of control, the author regards the prospects of success through breeding for resistance as remote or non-existent. Of the fungicides tested in the laboratory, mercuric chloride, the same and sodium chloride in equal parts, sodium selenite, nickel and silver nitrates, formalin, malachite green, abavit, uspulun, and germisan gave promising results; the effects of malachite green were particularly striking, the growth of the pycnospores and mycelium being inhibited at dosages of 0·00005 and 0·0001 per cent., respectively, and both killed by an hour's exposure to a 0·001 per cent. concentration. By Henry and Wagner's method of applying fungicidal sprays to half Petri-dish cultures [ibid., xx, p. 127], excellent results were obtained with malachite green (0·01 per cent.) and germisan 3559 (0·3 and 0·2 per cent.), which totally inhibited mycelial growth on the treated halves, whereas the diameter of the colonies on the unsprayed sections after a week was 18 to 20 mm. In field experiments in 1943 and 1944, one or two applications of Bordeaux mixture, 0·2 per cent. germisan, or 0·01 per cent. malachite green significantly reduced the incidence of stem rot and increased the seed yield. With further improvements in the composition of the fungicides and the technique of their application, still better results may be expected, but in the writer's opinion, effective control can only be achieved by the radical extirpation of the sexual phase of the pathogen, preferably by uprooting the entire plant before threshing, not merely cutting it off just above soil-level, and burning the roots with the rest of the debris when the operations are completed.

Howard (F. L.) & Andersen (E. M.). **Susceptibility of Logan and Florida Belle Beans to Fusarium yellows.**—Abs. in *Phytopathology*, xxxv, 8, p. 655, 1945.

Of 11 bean varieties planted in a randomized, four-replicate design at the Rhode Island Agricultural Experiment Station in 1944, two (Logan and Florida Belle) developed characteristic *Fusarium* yellows [*R.A.M.*, xiv, p. 207]. At the close of the picking season on 1st September, following a dry summer with high soil temperatures, 37 and 45 per cent. of the Florida Belle and 82 per cent. of the Logan foliage was dead. These results emphasize the necessity of testing new varieties for their adaptability to local soil conditions before extensive plantings are made.

Hildebrand (A. A.), Miller (J. J.), & Kock (L. W.). **Some studies of Macrophomina phaseoli (Maubl.) Ashby in Ontario.**—*Sci. Agric.*, xxv, 11, pp. 690–706, 8 figs., 1945.

In this paper a morphological comparison is made of two Ontario and Texas isolates of *Macrophomina phaseoli* [*R.A.M.*, vi, p. 757; xxiii, p. 187] and a test of their pathogenicity on soy bean (variety A. K. Harrow) and maize (inbred line Hy) described. The Ontario isolate came from a field specimen of soy bean exhibiting symptoms characteristic of charcoal rot and the other from a diseased cotton plant from Texas. The Ontario strain acted as a facultative parasite on stems of greenhouse-reared soy-bean plants, inoculated through artificial wounds, infesting the plants only as they grew old. Pycnidia, as well as the more common sclerotia, developed on a few plants. Pathogenicity remained facultative when both maize and soy-beans were cultivated at controlled temperatures of 21°, 27°, and 33° C.

in sterilized soil infected by the respective strains, but developed earlier at the higher temperatures. Greyish areas of infection symptomatic of charcoal rot, on the underground portion of soy-bean stems prove strains to be primary parasites, though in a limited degree. Out of 102 stems of maize and soy-bean plants similarly inoculated, but at soil-level, eight maize and seven soy-bean specimens tested became infected, earlier at the higher temperatures, as in the previous experiment, than at the lower. The specificity [? greater virulence] of the Ontario isolate is indicated by the fact that 14 out of the 15 plants infected had been inoculated with the Ontario strain. Parasitism again remained facultative in all cases.

Pycnidia, varying from 100 to 200 μ, with a conspicuous truncate ostiole and a membranous to subcarbonaceous wall, were produced on some greenhouse-grown soy-bean plants inoculated with the Ontario strain, but not in culture. Two hundred conidia, borne on simple, rod-shaped conidiophores, from five different pycnidia ranged from 12·6 to 28 μ by 8·4 to 10·5 μ, with an average of 21 by 9·3 μ. Cultures of mono-conidial origin produced the sclerotial form. Thus the genetical connexion between the two states of the organism occurring on the soy-bean was established for the first time, and the morphology of the pycnidia, conidia, and sclerotia made possible its determination as *M. phaseoli*.

The two strains may be distinguished by differences in the size and number of sclerotia produced in culture. Sclerotia of the Ontario strain on the original specimen and on inoculated plants measured 89·6 by 74·8 μ and 91·3 by 76·8 μ, respectively, average 90·4 by 75·8 μ; in culture the average size was 99·9 by 89·4 μ. In culture, sclerotia of the Texas strain averaged 85·4 by 73·0 μ, and were produced in greater numbers, giving the culture a much darker colour. Viability of cultured sclerotia in both strains decreased with age. On the other hand, sclerotia from the original soy-bean herbarium specimen showed no loss of viability after eight months.

Doran (W. L.) & Sproston (T.). **Control of Onion smut by fungicides applied to the soil.**—Abs. in *Phytopathology*, xxxvii, 8, p. 654, 1945.

Onion smut (*Urocystis cepulae*) was effectively combated in greenhouse tests [at the Massachusetts Agricultural Experimental Station] by the application to the soil, immediately before sowing, of a mixture of fermate and 5–8–7 fertilizer [*R.A.M.*, xxiv, p. 405] in proportions of 58 : 1,500 lb. per acre. The fertilizer alone decreased the incidence of infection to some extent. In a typical case, for instance, the percentage of smutted seedlings in the untreated plots and in those receiving (*a*) fertilizer alone and (*b*) fertilizer and fermate were 88, 56, and 1 respectively. Comparable results were secured with arasan. The disease was also reasonably well controlled by puratized N5X [ibid., xxiv, p. 443] and the nitrites of sodium and calcium, while the amount of infection was reduced to some extent by urea and calcium cyanamide, which were, however, like potassium dichromate, somewhat injurious to the crop.

Asthana (R. P.). **The influence of chemical manures upon 'white rot' of Allium.** —*Proc. Indian Acad. Sci.*, Sect. B, xxii, 3, pp. 168–174, 1945.

In a series of experiments carried out at Slough (Buckinghamshire) in 1931 and 1932 to determine the influence of certain chemical manures on the development of white rot (*Sclerotium cepivorum*) in White Spring Lisbon onions [*R.A.M.*, xxiv, p. 219] raised from inoculated seed, heavy applications of potassium sulphate (2 cwt. per acre) resulted in some reduction of infection on dry, light soil, the percentage of healthy plants in the plots so treated amounting to 34·5 compared with 25 in the unmanured. The beneficial effect of the compound was apparently correlated with enhanced resistance of the tissues to invasion by the pathogen; a similar but even stronger anti-fungal action was exerted by lime ('limbux') at 2 or

5 tons per acre. The weight and size of the bulbs on light, sandy soil were appreciably increased by ammonium sulphate at 2 or 8 cwt. per acre. There was no comparable response on peaty, wet soil.

BLEDSOE (R. W.), HARRIS (H. C.), & CLARK (F.). **The importance of Peanuts left in the soil in the interpretation of increases in yield due to sulphur treatments.** —*J. Amer. Soc. Agron.*, xxxvii, 9, pp. 689–695, 1945.

In general, sulphur dust treatments did not materially affect the total yields of Florida Runner groundnuts or the incidence of leaf spot [*Cercospora arachidicola* and *C. personata*: *R.A.M.*, xxiv, p. 269] on 420 plots at the Florida Agricultural Experiment Station in 1944. In two tests there were significant increases in the yields of the nuts on the vines, but when the number of those left in the soil was taken into account there was no appreciable difference in the total output of the dusted and untreated plots, suggesting that the sulphur merely contributed to the retention of the nuts on the vines.

TRESCHOW (C.). **Bekaempelse af Mycogone perniciosa i Champignonkulturer.** [Control of *Mycogone perniciosa* on cultivated Mushroom plots.]—*Friesia*, ii, 4–5, pp. 232–238, 1942–1943. [English summary.]

On a 200 sq. m. cultivated mushroom bed near Copenhagen, 85 per cent. of the white mushroom (*Psalliota hortensis* f. *albida* sensu Lange, Flora Agaricina Danica, iv, 1939) [*R.A.M.*, xxi, p. 429] crop was lost in the summer of 1942 as a result of attack by *Mycogone perniciosa*, from which the brown mushroom (*P. hortensis* f. *avellanea* sensu Lange) is immune. Applications of Bordeaux mixture 1–1–50 to the beds at the rate of 1 l. per sq. m. during the period between the flushes controlled *M. perniciosa*, the number of infected fruit bodies falling by 90 to 100 per cent. without injury being caused to the fungus culture. Useful control was also given by a composition of 1·5 per cent. phenol and 80 per cent. mineral oil, using 1 l. per sq. m., but the crop suffers and the harvest is retarded. Fruit tree carbolineum (composed of 5 per cent. phenol and 75 per cent. coal-tar oil) proved lethal to mushrooms when used at a strength of 2 per cent. at the rate of 1 l. per sq. m.

POSNETTE (A. E.). **Root-rot of Cocoyams (Xanthosoma sagittifolium Schott).**—*Trop. Agriculture, Trin.*, xxii, 9, pp. 164–170, 1945.

The history of root-rot of coco-yams (*Xanthosoma sagittifolium*), as recorded by Dade, Wright, and Shepherd [*R.A.M.*, xix, p. 581] indicates a recent origin, and spread from widely separated localities. In 1930 an outbreak occurred near Axim, and spread thirty miles north to the Enchi district by 1932, being reported in the Kumasi district in 1933, near Wiawso in Western Province in 1936, and Togoland in 1939, up to the 1943–4 season.

In 1940, a farmer in the Bekwai district of Ashanti was said to have succeeded in avoiding the disease by roguing all coco-yams found on his land after clearing the bush, and then replanting with material from an area free from root rot. These facts suggested the presence of a virus, with properties like those of the tobacco necrosis virus, which infects the roots of tobacco plants grown in contaminated soil, although the tops remain free from attack. The recovery of affected plants when growing in 'garden compost' as reported by Shepherd [loc. cit.] does not always occur and may not be permanent; nor does the planting of legumes as an intercrop while coco-yams are sprouting, or burning the bush and letting it rot on the land, have any effect in retarding root rot. Roguing all coco-yam plants and dormant corms before planting does delay and reduce the incidence of the disease, though only for one season, but, if it is not done, healthy setts introduced soon die. Moreover, the removal of all wild coco-yams is more important than the introduction of resistant or more vigorous plants. Experiments on the relative effects of soil and

plant infection indicated that the pathogen remains in the soil when all coco-yams are removed after an outbreak and that infected plants may recover when planted in disease free soil, though such recovery is often temporary. Plot trials showed that the disease spreads not through a progressive change in the soil, such as the development of a toxin, but by the dispersal of a pathogen. An experiment designed to find out whether or not the disease could be carried in the plant tissues showed that it is either carried inside the cormels from an affected plant or is resistant to surface sterilization; this suggested a systemic infection. A third experiment was undertaken to ascertain whether the disease could be transmitted by inoculation with crushed diseased roots, using carborundum as an abrasive. Five out of nine healthy plants so treated were found, four months after replanting, with poor root-systems, lesions on roots, and the remains of many rotten roots. The other four plants showed no symptoms of disease on examination. Petioles of plants which had become diseased after growing for one year in soil taken from a diseased area were grafted into incised slots in the petioles of plants grown in healthy soil; the originally healthy stocks were found to be diseased on examination three months later. This showed that the disease is transmissible. Then the soil, which had been healthy and in which the hitherto healthy plants had been grown, was used for the purpose of receiving another set of healthy plants. The fact that these also became infected after three months is held to prove the capacity of the pathogen to infect the soil which it enters.

Of eight varieties of coco-yam tested in resistance trials, *X. violaceum* var. Yautia Palma proved to be strongly resistant, but it is inedible. Conbiche and Morado are more tolerant than the local types, but not enough to be of economic value. It is suggested, as a working hypothesis, that the disease is caused by a virus which attacks the roots, and renders the plant susceptible to secondary attack by weak parasites.

Bosc (M.). **Cytologie des zoospores de Plasmopara viticola Berl. et de Toni.** [Cytology of the zoospores of *Plasmopara viticola* Berl. & de Toni.]—*C.R. Acad. Sci., Paris*, ccxx, 12, pp. 407–409, 1 fig., 1945.

Fixed in Champy and Duboscq-Brasil's liquid, distributed on the agar medium by E. Chatton's technique (*Bull. Histol. Tech. micr.*, vi, p. 268, 1929), and stained with Heidenhain's haematoxylin, the zoospores emerging from the conidia of *Plasmopara viticola* appear as rounded, mostly rectilinear, sometimes flexuous rods, 10 μ in diameter. The piriform or slightly ovoid nucleus, containing a nucleolus, may be connected with a centrosome, from which proceed two flagella, up to 25 or 30 μ in length, terminating in a spatule. When the zoospore is in motion, one flagellum is seen to act as an oar and the other as a rudder.

Williams (R. C.) & Wyckoff (R. W. G.). **Electron shadow-micrography of virus particles.**—*Proc. Soc. exp. Biol., N.Y.*, lviii, 3, pp. 265–270, 6 figs., 1945.

The authors describe a new technique for the electron microscopy of small objects, including the particles of the tobacco mosaic virus [*R.A.M.*, xxv, p. 25], involving the oblique evaporation of a film of chromium, 7 mμ. in thickness, over the preparation before micrography. The tridimensional effect thus produced gives new information about the heights and shapes of objects seen in the preparation.

Manil (P.). **À propos de la classification des virus phytopathogènes.** [On the classification of phytopathogenic viruses.]—*Bull. Soc. Bot. Belg.*, lxxii, 2, pp. 130–139, 1940. [Received October, 1945.]

After discussing the difficulties attendant on the task of finding a rational method of classifying plant viruses [cf. *R.A.M.*, xxii, p. 446; xxiii, p. 79], the author

reviews the systems of classification that have been proposed from time to time by various workers, and draws the following conclusions. Any rational system must be based on the intrinsic qualities of the viruses, i.e., their properties *in vitro*, their serological reactions, and their methods of transmission. Symptomatology enters into the matter, at least in principle, only in so far as it can be used to differentiate physiologic races. To classify viruses solely on a basis of their plant hosts and the symptoms produced therein is, in the author's opinion, indefensible. The ideal method of classification would be to group viruses according to their chemical, physical, and serological affinities, but this can be done, at present, only with a few; with the remainder, identification must be based on such stable characters as transmission by a particular insect species with or without an incubation period, longevity *in vitro*, specificity of hosts, and serological reactions. In classifying (though not, of course, describing) viruses, terms based on symptomatology such as mosaic, frisolée, curling, ruffling, and crinkle, must be as far as possible shunned.

MANIL (P.). **Où en est le problème de la nature des ultravirus?** [How far has the problem of the nature of ultraviruses advanced?]—*Bull. Soc. Bot. Belg.*, lxxii, 1, pp. 22–29, 1939. [Received October, 1945.]

The author briefly reviews the different hypotheses that have been put forward since the end of the last century as to the nature of filterable viruses, and expresses the opinion that an impartial survey of the evidence shows that viruses are infra-microbes, though obligatory parasites.

LIMASSET (P.) & CAIRASCHI (E. A.). **Les maladies à virus des plantes.** [Plant virus diseases.]—Paris, Imprimerie Nationale, 88 pp., 1941. [Received September, 1945.]

The first part of this monograph (by Limasset) deals mainly with the symptoms of plant virus diseases, the transmission and conservation of these conditions, the physiology of affected plants, virus strains, immunity, the serological properties of plant viruses, their physico-chemical characteristics and purification, and their classification and nomenclature. In the second part (pp. 81–88), both authors deal jointly with the question of control and discuss the direction which further research should take.

CONNERS (I. L.) & SAVILLE (D. B. O.). **Twenty-fourth Annual Report of the Canadian Plant Disease Surevy, 1944.**—xviii+122 pp., 1945. [Mimeographed.]

In this report [cf. *R.A.M.*, xxiv, p. 4], it is stated that wheat stem rust (*Puccinia graminis*) [ibid., xxiv, pp. 142, 309] is no longer of economic importance in the Prairie Provinces of Canada. Stem rust of oats is declining in importance in Manitoba and elsewhere. Physiologic races able to attack the new resistant varieties of wheat and oats were less prevalent in 1944 than in 1943. The new oat variety, Beaver, which combines resistance to stem rust and crown rust [*P. coronata*] has shown itself in experimental trials to be superior in yield and quality to the pre rot varieties, Vanguard and Erban [cf. ibid., xxiv, pp. 144, 186]. Common rootsent of wheat, due to *Helminthosporium sativum* and *Fusarium* spp., was destructive throughout the Prairie Provinces; it was slightly more prevalent in Alberta, slightly less so in Saskatchewan, and much more severe in Manitoba in 1944 than in 1943. False loose smut or black smut (*Ustilago nigra*) of barley was present in 14 per cent. of the collections of loose smuts (*U. nuda* and *U. nigra*) from Alberta, in 35 per cent. from Saskatchewan, in 44 per cent. from Manitoba, and in 25 per cent. from Quebec. A strain of a species of *Septoria* similar to *S. nodorum* [ibid., xxiv, p. 222], but with longer spores, was reported by T. Johnson on wheat and barley in Manitoba; infection was largely confined to the leaves, and was followed, late in the season, by a *Leptosphaeria* stage.

Lucerne bacterial wilt (*Corynebacterium insidiosum*) [ibid., xxiv, pp. 62, 192] continued to spread in Alberta [ibid., xxii, p. 9], and is now established outside the irrigated districts, though not yet present in the important seed-producing area of Cherhill-Sangudo-Westlock.

Flax rust (*Melampsora lini*) was less destructive than in recent years, largely owing to the replacement of the susceptible Bison variety by the resistant Royal. 'Pasmo' disease (*Septoria linicola*) occurred in Manitoba, but not in Saskatchewan, and what, apparently, was the perfect stage (*Sphaerella linicola*) [*S. linorum*: ibid., xxiii, p. 487] was found on fibre flax from Portage la Prairie, Manitoba.

Soy-bean diseases were of only slight importance in south-western Ontario, but bud blight due to the tobacco ring-spot virus [ibid., xxiv, p. 133] and charcoal rot (*Macrophomina phaseoli*) [ibid., xxii, p. 463] were recognized for the first time.

Yellows (*Callistephus* virus 1) [aster yellows virus] occurred on carrots [ibid., xxiv, p. 5] in epidemic proportions across Canada, one severe outbreak being observed in Ontario, where the disease has not before been recorded. Aster yellows virus was found on onions for the first time, the condition being prevalent near Winnipeg in 1944, and round Grand Forks, British Columbia, in 1943. Yellows of celery [aster yellows virus: ibid., xxii, pp. 382, 415], known previously in Canada only from a few scattered reports in Alberta, was again reported from this locality, and was also noted in Saskatchewan. The same disease also attacked buckwheat, kok saghyz [*Taraxacum kok-saghyz*: ibid., xxiv, p. 4], lettuce, parsnip, pumpkin, squash, *Calendula*, *Callistephus*, *Centaurea*, *Clarkia*, *Coreopsis*, *Cosmos*, *Dahlia*, *Dimorphotheca*, *Eschscholtzia*, *Gaillardia*, *Nigella*, *Petunia*, *Phlox*, *Schizanthus*, *Tagetes*, and *Zinnia*. Purple top of potatoes [aster yellows virus: ibid., xxiii, p. 3; xxiv, p. 5] was more general than during any year before.

Potato bacterial ring rot (*Corynebacterium sepedonicum*) [ibid., xxiv, pp. 5, 337] is one of the most important diseases affecting table stock in Canada. The only means of control recommended is the complete eradication of the disease as it occurs on individual farms. Once the disease is established, it can only be eliminated through regulations enacted and enforced by each Province. Special legislation against it has so far been passed by British Columbia, Alberta, Manitoba, Ontario, and Prince Edward Island. It has not become established in British Columbia, Nova Scotia, and Prince Edward Island, though the last-named province may not be entirely free from it, but in all the other provinces it is present in varying amounts. A survey carried out annually in Alberta since 1939 showed that the rate of spread and the severity of the disease have both declined. In Saskatchewan, the disease is probably more prevalent than the reports received have indicated. It is well established in Manitoba, light infection having been observed in about 25 per cent. of the lots examined in field and market. A thorough survey gave a marked increase in the number of infected fields in Ontario, but the eradication campaign carried out on farms where the disease was found in 1943 gave encouraging results. There is evidence of considerable infection in Quebec.

The amount of leaf roll and mosaic present in the certified potato crop showed a marked reduction.

Verticillium dahliae was noted for the first time in the Okanagan Valley, British Columbia, on apricot, cherry, and peach.

The occurrence of Dutch elm disease (*Ceratostomella ulmi*) in Canada was established late in 1944, when Dr. R. Pomerleau received specimens from St. Ours, near Sorel, Quebec. Before the end of the season, 28 infected trees were discovered in an area about 40 miles long near Lake St. Peter, about 50 miles below Montreal.

Needle blight (*Rehmiellopsis bohemica*) [ibid., xvi, p. 786; and above, p. 51] occurred on balsam fir [*Abies balsamea*] in Cape Breton Island, Nova Scotia.

Plant Diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, lvi, 10, pp. 457–459, 3 figs., 1945.

The chief types of viruses causing deterioration of potato tubers in New South Wales are leaf roll, virus X, virus A, and virus Y, while other viruses which are important occasionally are those of witches' broom, aucuba mosaic, and [tomato] spotted wilt. Some progress has already been made locally in building up lines of Factor and Bismarck potatoes free from virus X [cf. *R.A.M.*, xxiii, pp. 75, 166].

The most prevalent disease of silver beet locally is leaf spot (*Cercospora beticola*) [ibid., xxiii, p. 377]. The fungus also attacks beetroot [loc. cit.], on which, however, the damage caused is much less severe.

Noël (Christiane). **Recherches anatomiques sur le début de tumeurs corticales obtenues par inoculations superficielles de Phytomonas tumefaciens sur des tiges de Pelargonium zonale.** [Anatomical studies on the inception of cortical tumours induced by superficial inoculations of *Phytomonas tumefaciens* on *Pelargonium zonale* stems.]—*C.R. Acad. Sci., Paris*, ccxviii, 5, pp. 205–207, 1 fig., 1 diag., 1944.

By painting young internodes of *Pelargonium zonale* with a brush steeped in a culture solution of *Phytomonas* [*Bacterium*] *tumefaciens* the writer induced the formation of minute tumours on the stem surface, proliferation being most active among the cells of the subepidermal layer but occurring also to a lesser extent in those of the epidermis and the second cortical layer [*R.A.M.*, xvi, p. 590 *et passim*]. In some cases, development ceased at the end of a fortnight, while other tumours developed a complex structure comprising generative liberoligneous zones. The surrounding cortical tissue, moreover, undergoes hypertrophy, bacterial infiltrations penetrate into the healthy areas, and the surface of the tumour becomes suberized. The mere passage of a paint-brush over the internodes sufficed to break the hairs and rupture the epidermal cells at their bases, but the proliferation resulting from this stimulus was of brief duration.

Revilla (V. A.). **Razas fisiológicas de la roya negra del Trigo (Puccinia graminis tritici) encontrados en el Perú.** [Physiologic races of the black rust of Wheat (*Puccinia graminis tritici*) encountered in Peru.]—*Bol. Estac. exp. agríc., Lima*, 26, 16, 1 col. pl., 2 diags. (1 col.), 1 map, 1945. [English summary.]

Mention has already been made by Barducci of the author's work on the determination of the physiologic races of wheat black rust (*Puccinia graminis tritici*) occurring in Peru [*R.A.M.*, xxv, p. 30]. His researches have established the existence in the country, in addition to the races already known to be present, including 48 and the supervirulent 189, of 14 and 15, of which the latter is the more destructive and widespread. Of a total of 23 isolates from four Departments, 17 were identified as belonging to race 15, viz., eight from Lima, five from Ayacucho, and two each from Ancash and Apurimac.

Stakman (E. C.), Loegering (W. Q.), & Cotter (R. U.). **Physiologic races of Puccinia graminis in the United States in 1940.**—U.S. Dep. Agric., B.E.P.Q., E-522-A, 18 pp., 1 graph, 1942.

Stakman (E. C.) & Loegering (W. Q.). **Physiologic races of Puccinia graminis in the United States in 1941.**—Ibid., E-522-B, 11 pp., 2 graphs, 1942. [Mimeographed. Received November, 1945.]

These are, respectively, the second and third annual reports on physiologic race surveys of *Puccinia graminis tritici* and *P. graminis avenae* in the United States [*R.A.M.*, xxiii, pp. 58, 433].

Bergal (P.). **Traitement industriel des Orges à deux rangs (Hordeum distichum L.) contre le charbon nu (Ustilago nuda).** [Industrial treatment of two-rowed Barley (*Hordeum distichum*) *L.* against loose smut (*Ustilago nuda*).]—*C.R. Acad. Sci., Paris*, ccxviii, 10, pp. 423–424, 1944.

In 1942 one of the best French brewing barleys, Aurore, was infected by loose smut (*Ustilago nuda*) in certain districts to the extent of 1 to 10 per cent. or more, and in 1943 the same variety was attacked throughout the range of its cultivation, the average incidence of the disease amounting to between 4 and 6 per cent., with a fair number of fields showing 10 or even 14 per cent. No installation for the application of the hot-water treatment (the sole effective method of combating the smut) existing in France, it was necessary to improvise a method with the available brewery equipment, consisting of 12 vats for pasteurization, with a capacity of 880 l. each, of which eight served for the first immersion of 50 minutes at 45° C. and four for the second of 15 to 18 minutes at 52°. The seed-grain was placed in hampers of wood and fine wire gauze (60 kg. in each). After the second bath it was chilled under a jet of water and dried at 45° for 12 to 13 hours to reduce the moisture content from 35 to 15 per cent. An average of 38 quintals [1quintal = 50 kg.] was treated in an eight-hour day. Germinative capacity was not seriously impaired by the treatment but the rate of germination was appreciably retarded and did not acquire the normal velocity for five or six days, as compared with 48 hours for untreated seed. The results of the treatment in respect of loose smut control were not known at the time of writing.

Brundza (K.). **Pflanzenpathologie im Ostland. IV. Mitteilung. Der Roggenschneeschimmel in Litauen.** [Plant pathology in the Ostland. Note IV. The Rye snow fungus in Lithuania.]—*Angew. Bot.*, xxv, 5–6, pp. 324–338, 2 maps, 1943. [Received November, 1945.]

The rye snow fungus [*Calonectria graminicola*] and its depredations have scarcely been investigated in Lithuania, and little or nothing has been done to combat it [cf. *R.A.M.*, xxii, p. 263]. In commenting upon losses caused by the disease from the year 1927 onwards the author states that in 1930 the area ploughed up on account of winter injury amounted to only 0·1 per cent. of the total, but in 1931, which brought heavy snow, severe losses were experienced, up to 12·9 per cent. of the land in the Tauroggen district being reploughed. From 1935 until 1942 the average areas reploughed from winter injury (including *C. graminicola*) in the rye and wheat crops ranged from 0·8 to 2·6 and from 0·3 to 2·4 per cent., respectively. For the six years from 1935 to 1940, inclusive, the total areas reploughed in the rye crop over the whole country amounted to 0·7, 2·7, 0·8, 2·5, 0·5, and 1 per cent., respectively. A superficial survey of these data would not reveal the importance of the snow mould and the associated factors responsible for winter injury, because the farmer only ploughs up the hopelessly unproductive fields, and the relevant data therefore do not include cases of slighter damage. There is, however, authentic evidence that in some parts of the country infection by *C. graminicola* has involved 70 per cent. of the total area under winter wheat and rye, only 25 per cent. of which was ploughed up. Rye tends to suffer more from infection by *C. graminicola* than wheat, while the latter is more susceptible to winter frosts, which may, however, also destroy the rye crop without any intervention from the fungus.

With the exception of 1934 and 1935, winter injury during the period under review shows a well-marked alternative rhythm, a year of severe losses being followed by one of only slight reductions in the cereal stands. In general, the north coast and central districts appear to sustain the heaviest damage from the winter-injury complex. Low June temperatures (mean of 13·7° to 15·3° C. in five localities over a 14-year period) were found to be conducive to the development of the pathogen.

Tests on the reactions to snow mould of some indigenous rye varieties, mostly selections from the Dotnuva Plant Breeding Station, in comparison with Lochow's Petkuser, Rumker, Dankowo, and Svalöf's Panzer, in various localities from 1927 to 1940, showed the former group to be more resistant than the foreign introductions.

The soils over a large part of the area suffering the most extensive damage from winter injury are more or less acid, and it is probable that systematic liming, coupled with drainage, would afford a considerable measure of control. In the meantime, seed-grain disinfection with an approved fungicide is the sole treatment that can be recommended.

MASTENBROEK (C.) & OORT (A. J. P.). **Het voorkomen van moederkoren (Claviceps) op granen en grassen en de specialisatie van de moederkorenschimmel.** [The occurrence of ergot (*Claviceps*) on cereals and grasses and the specialization of the ergot fungus.]—*Tijdschr. PlZiekt.*, xlvii, pp. 165–185, 2 pl., 2 maps, 1941. [English summary. Received November, 1945.]

During the summer of 1940, observations were made on the distribution of *Claviceps* spp. in the environs of Wageningen and the provinces of Gelderland and North Brabant. *C. purpurea*, *C. microcephala* [referred by Petch to *C. purpurea*: *R.A.M.*, xvii, p. 269], and *C. wilsoni* [ibid., xvi, p. 447] appeared to be very widespread. *C. purpurea* was collected on rye and 19 grasses, of which *Lolium perenne* was the most commonly attacked, followed by *Dactylis glomerata*. *Triticum repens*, and *Festuca* and *Holcus* spp. *Molinia coerulea* was the chief host of *C. microcephala*, which also occurred on *Phragmites communis*, *Deschampsia caespitosa*, and *Poa annua*. *C. wilsoni*, not previously recorded under this name in Holland, where it has been confused with *C. purpurea*, was found on *Glyceria fluitans* only. *C. nigricans* was not detected in nature in the course of the present survey, but was identified on a Utrecht herbarium specimen of *Heleocharis palustris* dated 1938.

Cross-inoculation experiments were carried out with Spanish, Dutch, Polish, and Canadian isolates of *C. purpurea* from rye and with Dutch collections of the same species from *F. arundinacea*, *L. perenne*, and *Bromus erectus*. The three European isolates from rye appeared to be identical with Stäger's rye form [ibid., iii, p. 85], called p_1 by Barger [ibid., xi, p. 445], but the grass collections were shown to belong to a new physiologic race, p_4, characterized by pathogenicity to the grasses attacked by p_1, as well as to *L. perenne* and *B. erectus*, which have hitherto been susceptible only to Stäger's *Lolium* form (Barger's p_3). Convincing evidence was afforded by cross-inoculation experiments with ascospores and conidia on rye, *B. erectus*, and *L. perenne* that the new race is a distinct entity and not, as was first assumed, a mixture of p_1 and p_3. The Canadian rye strain occupies an intermediate position between p_1 and p_4, *L. perenne*, for instance, contracting only mild infection after a lengthy incubation period, and further experiments should be undertaken to determine its exact relation to the known physiologic races of *C. purpurea*.

Stäger in Switzerland, as well as the authors in Holland, observed cases of severe ergot infection on rye and *L. perenne* growing in close proximity, both crops having presumably been attacked by physiologic race p_4, though in neither country has this strain been found on rye in nature.

Although all the grasses listed in this paper were known to be hosts of *Claviceps*, no information was hitherto available as to the species occurring on them. The experiments herein described have shown *C. purpurea* to be transmissible to *F. ovina*, *F. rubra*, *Alopecurus pratensis*, *A. geniculatus*, *Phleum pratense*, *Poa nemoralis*, *Holcus lanatus*, and *Hordeum arenarium*.

STOLL (A.). **Altes und Neues über Mutterkorn.** [Old and new about ergot.]—*Mitt. naturf. Ges. Bern.*, c, pp. 45–80, 23 figs., 1943. [Received December, 1945.]

The author summarizes the available information concerning rye ergot (*Clavi-*

ceps purpurea) and its medicinal applications from the earliest times to the present day, concluding with an account of the experiments in progress in Switzerland on sclerotial production by the manual or mechanical inoculation of growing crops [*R.A.M.*, xxiv, p. 408]. By the use of a pistol apparatus constructed by W. Hecht (Schweiz. Pat. 211, 619, 1940), in which the inoculum is sprayed simultaneously through a number of hollow needles into the closed ears of the plants, several thousand kilogrammes of ergot were obtained in 1939, the best climatic conditions and the most active collaboration on the part of the farmers being afforded by the Berne environs. By this method an average of 1 are [100 sq.m.] of rye can be treated daily, but since the critical period for inoculation (extending from the emergence of the ear from the haulm until 8 or 10 days before flowering) usually coincides with the hay harvest, the necessary labour is frequently lacking, and a mechanical contrivance had therefore to be sought for large-scale operations. Von Békésy's machine [*R.A.M.*, xviii, p. 314] was accordingly adapted, with the co-operation of the Bucher-Guyer factory (Niederweningen), and proved to be serviceable for the end in view. The inoculum, consisting of suspensions containing about 100 conidia per cu.mm., is sprayed into the ears about a fortnight before flowering, and 12 to 14 days later large drops of honeydew appear, to be followed in a few weeks by the primary, and in another fortnight by the secondary sclerotia, the latter generally constituting the bulk of the harvest. As many as 54 sclerotia have been counted on a single inoculated ear, and in isolated cases (three to date) these organs are also formed on the haulm nodes. A culture of a colourless strain of *C. purpurea* yielded in a preliminary test over 70 kg. of leuco-sclerotia with a qualitatively normal alkaloid content.

The risk of any appreciable increase in the normal incidence of ergot in neighbouring rye fields through the inoculation operations is inconsiderable. Thanks largely to these undertakings the Swiss supply of medicinal ergot is secured for years to come, even if the importation of the drug from abroad should cease entirely.

Bain (D. C.). **The sooty stripe disease of Sorghum.**—*Phytopathology*, xxxv, 9, pp. 738–739, 1 fig., 1945.

Since 1942, when it was first reported from the United States, sooty stripe of sorghum (*Titaeospora andropogonis*) [*R.A.M.*, xxi, p. 286] appears to have been spreading in Louisiana and Mississippi. In addition to information already presented, the author briefly describes the symptoms as reminiscent of those caused by *Helminthosporium turcicum*, the fairly regular, elongate-elliptic lesions measuring up to several centimetres in length and 1 to 2 in width and being of a light brown to greyish colour in the centre with a broad, deep red margin. Small, rough, spherical or subspherical, evanescent black bodies, suggesting the common name of 'sooty stripe', develop on the spots as early as July and are believed to represent sclerotia. Growth in pure culture is slow, the mycelium forming a rather dark, greenish-grey clump; conidia are produced in abundance in pinkish, filiform masses in three to four days and germinate freely within 20 hours, while chlamydospores develop readily on bean pod agar. In inoculation experiments the largest lesions were formed on the White Kaoliang, C. P. Special, Standard Broomcorn, and Dwarf Yellow Milo varieties.

Klotz (L. J.) & Middleton (J. T.). **Notes on copper spray damage to Citrus trees.**—*Calif. Citrogr.*, xxxi, 1, pp. 14–16, 1945.

Discussing damage caused to citrus trees in different parts of California in the past two years by copper sprays, the authors state that a harmful excess of soluble copper may be released by dull, cool weather, by the presence of honeydew, possibly by the use of ammonia and ammonium sulphate as fertilizers, and by air-

pollution from manufacturing plants and diesel motors. Spraying may also slightly aggravate mechanical injuries. Cyanide fumigation should not be given until one month has elapsed or heavy rain has intervened.

KLOTZ (L. J.) & PARKER (E. R.). **Suggestions for controlling brown rot, exanthema, and Septoria spot of Citrus.**—*Calif. Citrogr.*, xxxi, 1, p. 20, 1945.

In view of the injury caused to citrus trees recently in California by copper sprays [see preceding abstract] it is suggested that against brown rot [*Phytophthora citrophthora* and other spp.: *R.A.M.*, xxiii, p. 385] only the skirt of the tree to a height of 3 ft. should be sprayed in late October or early November, or before, if the rainy season starts early, with a mixture containing 1 lb. copper sulphate, 5 lb. zinc sulphate, and 4 lb. good-quality hydrated lime per 100 gals. spray. Applied to the whole tree, this spray is effective against *Septoria* [*citri* and *S. limonum*], mottle leaf [ibid., xix, p. 641], and, probably, exanthema [ibid., xx, p. 59]. To minimize the risk of copper injury, it would appear to be preferable to apply a dilute spray several times rather than to make a single application of a stronger one. Growers who have not experienced injury from copper sprays should continue to use Bordeaux mixture (3–3–100).

KOTILA (J. E.). **Cotton leaf spot Rhizoctonia and its perfect stage on Sugar Beets.**—*Phytopathology*, xxxv, 9, pp. 741–743, 1 fig., 1945.

The *Rhizoctonia* isolated by D. C. Neal from cotton leaf spots [in Louisiana: *R.A.M.*, xxiii, p. 485] caused damping-off of sugar beet seedlings under experimental conditions favouring the disease, the symptoms appearing three or four days after emergence and the stand being reduced to 61·5 per cent. of the control in ten days. At 21° to 25° C. and a relative humidity of 90 to 100 per cent. the cotton strain was mildly pathogenic to the foliage, the largest infected area ten days after inoculation measuring only 2 by 4 cm. The perfect state, which was not observed on cotton [loc. cit.], developed both on sand-maize meal and the foliar lesions, the hymenial cells, basidia, sterigmata and basidiospores agreeing with those of representatives of the group formerly referred to *Corticium vagum* (or *Pellicularia filamentosa*) [*C. solani*]. The average spore dimensions were 8·8 by 6·9 μ, and the length of the sterigmata approximately equalled the longest spore diameter.

VASUDEVA (R. S.). **Studies on the root-rot disease of Cotton in the Punjab. XIV. Effects of soil treatment on disease incidence.**—*Indian J. agric. Sci.*, xv, 1, pp. 36–42, 1 fig., 1945.

The author describes a number of abortive attempts by soil fumigation, cultural treatment, and the application of fertilizers to control root-rot disease of cotton (*Rhizoctonia* [*Corticium*] *solani* and *Macrophomina phaseoli*) in the Punjab [*R.A.M.*, xxiv, p. 484]. The use of paradichlorobenzene reduced the incidence of the rot, but delayed germination and caused smaller and stunted growth, while removal of diseased débris, additional farmyard manure, flooding, and five tillage treatments gave inappreciable results. Calcium chloride (2,281 lb. per acre), potassium chloride (210 lb.), and both together, among several chemical treatments tried, were the only ones to bring about a reduction of incidence on treated as compared with untreated plots (average mortality 35·9, 31·4, 34·8, and 59·6 per cent., respectively).

Red leaf in American Cotton (G[ossypium] hirsutum).—*Indian Fmg*, vi, 10, pp. 469–470, 1945.

Three kinds of reddening of the leaves of cotton plants [cf. *R.A.M.*, xxiii, p. 298] occur in India and may be present singly or jointly on the same plant. One is

preceded by yellowing, and is due to nitrogen deficiency. The remedy lies in the application of sulphate of ammonia. The second type is usually patchy and is associated with leaf crumpling caused by jassid attack. The third form is a genetic character, and in the absence of the other two kinds does no harm and may even be a desirable character, hastening plant maturity.

Ray (C.). **Anthracnose resistance in Flax.**—*Phytopathology*, xxxv, 9, pp. 688–694, 2 figs., 1945.

At the California Central Fibre Corporation, Pisgah Forest, North Carolina, the writer inoculated 88 flax varieties and selections in the seedling stage with spore suspensions of *Colletotrichum lini* and classified them in four groups according to their reactions. The unnamed introductions C.I. 1008 and 1009, Linota, and Buda 80 were specially free from infection, while other resistant types were three out of six Argentina selections (the others were moderately resistant), Buda, two Crystal selections, Golden Rio, two of Malabrigo, N.D. 40046, Portuguese selection, and one Rio. The susceptible group included two Abyssinians, two Hercules, J.W.S., and J.W.S. × Bison, Liral 12, Redwing, Russian fibre, and Viking, and the very susceptible two other Abyssinians, two Concurrents, and several of Indian origin, among them three Punjabs.

Oliveira (Maria de L.) & Borges (Maria de L.). **Estudo dos virus das crucíferas. II—Estirpes isoladas de Matthiola incana (L.) R.Br.** [Study of crucifer viruses. II—Strains isolated from *Matthiola incana* (L.) R.Br.]—*Bol. Soc. broteriana*, Sér. 2, xix, 3, pp. 265–272, 1944.

The first part of the authors' study, entitled 'Strains isolated from wild crucifers', was presented in the form of a thesis at the Portuguese-Spanish Congress for the Advancement of the Sciences, held at Cordova in 1944. It contained the information that seven strains of a virus isolated from *Rapistrum* spp. were pathogenic to cultivated crucifers, including turnip, stock (*Matthiola incana*), and wallflower (*Cheiranthus cheiri*). This second contribution deals with inoculation experiments by juice transmission on a number of cultivated and wild crucifers, tobacco, and *Nicotiana glutinosa*, with nine isolates of the stock virus [cf. *R.A.M.*, xxiii, p. 377], from Lisbon gardens.

On the basis of the data thus obtained, the following provisional scheme of classification was drawn up: strain G9, on *N. glutinosa* negative (—), cabbage positive (+); G8, on cabbage —, tobacco +; G3 on tobacco —; G1, on *N. glutinosa* +; *C. semperflorens* +; G5 on *C. semperflorens* —; G4 on *N. glutinosa* +, radish +; and G7, G2, and G6 on radish —. The symptoms induced by each of the isolates on the differential hosts are shown in tabular form and comprise, *inter alia*, mosaic, rugosity, stunting, chlorosis, necrosis, blistering, and streak.

Jacques (J. E.). **Une espèce d'Urophlyctis associée à une galle de Lathyrus japonicus.** [A species of *Urophlyctis* associated with a gall of *Lathyrus japonicus*.] —*Ann. Ass. canad.-franç. Sci.*, xi, pp. 98–99, 1945.

At St. Fabien in 1936 and at Anticosti, Quebec, in 1942, large galls (up to 5 cm. in diameter) were observed on the collar of *Lathyrus japonicus*. They were composed of diversely orientated parenchymatous tissue enclosing vascular bundles and unicellular cavities filled to capacity with the brown spores of a species of *Urophlyctis*, which on germination gave rise to one or two vesicles filled with dense protoplasm. This substance became differentiated into uniflagellate zoospores, which were liberated through a minute aperture and were motile for some time, all movement eventually ceasing at the periphery of the water drop.

Buchwald (N. F.). **Knippebakteriose (Bacterium fascians (Tilford) Lacey). En for Danmark ny Bakteriesygdom.** [Fasciation bacteriosis (*Bacterium fascians* (Tilford) Lacey). A new bacterial disease for Denmark.]—*Gartnertidende*, lviii, pp. 421–423, 2 figs., 1942. [Received November, 1945.]

Attention is drawn to the detection in 1938 of 'cockscomb galls' (fasciation) on sweet peas in Copenhagen, the causal organism of which was identified by Miss Lacey as *Bacterium* [*Corynebacterium*] *fascians* [*R.A.M.*, xxi, p. 365]. Ingrid Bergström has listed *Viburnum opulus* as one of the hosts of the pathogen in Sweden [ibid., xxii, p. 89], and from a comparison of her illustration of the symptoms with an infected Danish specimen (1929) of the same shrub, the identical agent appears to be clearly implicated in the latter case also. Control should consist in soil and seed disinfection and the exclusive use of healthy material for cuttings, division, and the like.

Mastenbroek (C.). **Enkele veldwaarnemingen over virusziekten van Lupine en een onderzoek over haar mozaiekziekte.** [Some field observations on Lupin virus diseases and a study on its mosaic disease.]—*Tijdschr. PlZiekt.*, xlviii, 7–8, pp. 97–118, 2 pl., 1942. [German summary. Received November, 1945.]

Following a review of the literature on lupin viruses in general, the author fully describes and tabulates the results of his studies on a destructive mosaic disease of sweet yellow lupins (*Lupinus luteus*) [cf. *R.A.M.*, xxiii, p. 301] in Holland.

Seed collected from a diseased crop in North Brabant was sown at Wageningen in 1940 and gave rise to plants characterized by abnormally narrow, erect, mottled pinnate leaves and mostly abortive flowers; they retained their green colour until the late autumn. These observations apply to plants with secondary infection, those to which it was primarily conveyed by aphids, presumably *Myzus persicae*, suffering less severely. Another disease resembling 'browning' [cucumber mosaic virus: ibid., xv, p. 510] developed somewhat later than the yellow lupin virus. Original v. Sengbusch seed sown in 1941 produced a healthy crop.

Of the plants inoculated with the yellow lupin virus by Rawlins and Tompkins's carborundum abrasion method [ibid., xv, p. 737], Double Stringless and Ceka beans, Alaska Perfection, and small green Dutch peas, Oldambster field and garden broad beans, Limburg Maas red clover, crimson clover, and yellow and white (*L. alba*, German and Creta) lupins reacted positively, while the response of blue lupins (*L. angustifolius*) was doubtful. In every case the predominant symptom was a mosaic pattern, only white lupins, especially Creta, developing an intensive necrosis. Of 170 yellow lupin seedlings arising from the seed of nine infected plants, 8 (about 5 per cent.) became diseased, but all 37 Double Stringless beans from the seed of two inoculated plants remained healthy.

The yellow lupin virus withstood a temperature of 60° to 70° C., and was still active after four days in darkness at 20° and in dilutions of 1 in 600. It was transmitted by aphids from yellow lupins to small green Dutch peas. The yellow lupin mosaic virus is regarded as distinct from any other hitherto described, and is named *Lupinus* virus 1. Control should consist in aphid extermination, early sowing, eradication of diseased plants, and the breeding of resistant varieties.

A preliminary note is given on a virus disease of white lupins resembling the yellow lupin mosaic but shown by inoculation experiments to be different.

Kienholz (J. R.) & Childs (L.). **Fungicides in relation to scab and fruit russet of Pear in the Hood River Valley, Oregon.**—*Phytopathology*, xxxv, 9, pp. 714–722, 1945.

Pear scab (*Venturia pirina*) has been particularly troublesome in Oregon since 1932 [*R.A.M.*, xvii, p. 324], and for the last 12 years attempts have been in progress to find a fungicide combining efficacy against the pathogen with non-injurious-

ness to Anjou and other spray-sensitive varieties, on which sulphur-containing materials cause severe russeting when the temperature exceeds 90° F., while other drawbacks to their use include rapid dissipation in warm weather and incompatibility with insecticides. A copper phosphate-lime-bentonite mixture (4–4–4–100) [ibid., xii, p. 709] gave equally good control with wettable sulphur (8–100), or better, and caused much less fruit russet in average seasons, but in wet summers it has proved less satisfactory as a fungicide, besides inflicting severe injury. During the last three years, excellent results have been secured on Anjou pears with fermate ($1\frac{1}{2}$–100) which in 1942, 1943, and 1944 reduced the incidence of scab from 56·4 to 3·8, 79·2 to 8, and 79·3 to 5 per cent., respectively, while the amounts of infection on the trees sprayed with copper phosphate were 8·6, 21·3, and 19·7, and on those treated with micronized wettable sulphur 9·9, 36, and 10·3, respectively.

In a heavily infected orchard of Bartlett pears, a variety not susceptible to spray injury, in 1944, lime-sulphur gave the best results, reducing fruit and leaf scab from 94·9 and 83 to 8·9 and 7·2 per cent., respectively, while the corresponding figures in the plots treated with fermate were 25·5 and 41·9 per cent. and with Bordeaux (4–4–100) 12·2 and 11·5 per cent., respectively. Fruit-russeting (37·2 per cent.) occurred only on the Bordeaux-sprayed trees.

In addition to suitable timing and numbering, thoroughness of application is an important factor in the success of anti-scab treatments, and care should be taken to provide the tree tops, where control tends to be poorest, with a liberal share of the fungicide. Thus, in a spraying test on the Anjou variety in 1943, using wettable sulphur, the amounts of infection on the bottom, middle, and top thirds of trees 25 ft. in height were 10, 14·5, and 23·2 per cent., and those of russet 62, 27·3, and 16·9, respectively.

Sulphur fungicides are apt to impart a yellow tinge to the foliage, a drawback that was absent from copper phosphate and fermate, the former in particular giving an attractive green coloration [cf. ibid., xvii, p. 608]. Fruit set was not reduced by copper phosphate or fermate in 1942 (the only year in which reliable data could be taken), whereas the sulphur-treated trees yielded only about a third as much fruit as the controls or those sprayed with the two first-named preparations.

Grosjean (J.). **Het vraagstuk van de loodglansziekte bij vruchtboomen.** [The problem of the silver leaf disease of fruit trees.]—*Tijdschr. PlZiekt.*, xlix, pp. 172–178, 1 pl., 1943. [Received November, 1945.]

Previous contributions to the study of silver leaf (*Stereum purpureum*) are reviewed, with special reference to the troublesome problem of control [*R.A.M.*, xi, p. 59]. It was ascertained in recent cultural experiments at the Phytopathological Institute, Wageningen, that the cortex of the balsam poplar (*Populus candicans*) contains a substance, or complex of substances, capable of greatly retarding the growth of *S. purpureum*, while that of *Fomes pomaceus*, another wood-rotting fungus [ibid., xxii, p. 118], was entirely inhibited. Further tests were accordingly carried out with extracts of the bark material, sterilized either by filtration through a Pasteur-Chamberland candle or by 15 minutes' heating at 110° C., and added at the rate of 5 c.c. to a medium of 10 c.c. cherry agar supporting *S. purpureum*. The development of the fungus was definitely arrested by the extracts, whether heated or not.

Another line of approach to the nature of resistance to *S. purpureum* was explored by A. F. Vlag, who inoculated the fungus into a number of plum trees of the susceptible Victoria and semi-resistant Ontario. The examination after a fixed period of sections of the wood from both groups revealed a fully viable mycelium in the susceptible variety, whereas in the resistant it had begun to disintegrate, beginning near the site of inoculation. Since the spread of the fungus was of equal extent in both cases, it is reasonable to assume that the inhibitory

effect exerted by the Ontarios was a property of some substance activated by the stimulus of infection.

Finally, Martha Bakker and J. B. Nijhoff observed that the growth of an isolate of *S. purpureum* from plum could be arrested by a culture filtrate of the same fungus from other sources.

DEMAREE (J. B.). **Rhizoctonia bud rot of Strawberry plants.**—*Phytopathology*, xxxv, 9, pp. 710–713, 1 fig., 1945.

A bud rot of strawberries, first reported by A. N. Brooks from Florida in 1935 [*R.A.M.*, xiv, p. 563] and attributed to a *Rhizoctonia* of the *solani* type [? *Corticium solani*], was later observed by the writer in Arkansas, Delaware, Maryland, Mississippi, North Carolina, and Tennessee, and by Bain in Louisiana and Mississippi (*Plant Dis. Reptr*, xxviii, p. 259, 1944). The flower and leaf buds are attacked during the few weeks coinciding with the resumption of new bud growth, namely, December and January in central Florida, February and March in southern Louisiana, and April and May in Maryland. Damage to field crops is not ordinarily extensive, the maximum incidence noted by the writer being 25 to 30 per cent. in Arkansas. Experimental evidence was obtained that covering the crowns with soil or sand did not induce abnormal growth of the leaves. The early symptoms of the disease may easily be confused with those caused by the sucking insect *Orthea vincta* in Florida, crown rot (*Sclerotinia sclerotiorum*), in southern Louisiana, and spring dwarf (*Aphelencoides fragariae*). On maize meal agar the fungus produces reddish-brown, loose hyphae and globose to flat, dark brown to black sclerotia, 0·5 to 1·25 mm. in diameter.

SCHAPPELE (N. A.). **The effect of P_H and of certain minor elements on the growth of Pineapples in water cultures.**—*J. Agric. P.R.*, xxvi, 3, pp. 63–72, 3 figs., 1945.

In studies at the Puerto Rico Agricultural Experiment Station on the effects of minor elements on the prevalent gumming disease of pineapples [*R.A.M.*, xxi, p. 408] and the commercially serious yellowing, it was found that manganese and to a lesser extent zinc tended to induce chlorosis, similar to that observed in the field, due to the inactivation of the iron in the plant. This condition was counteracted by adding aluminium and boron. A stunting of the root system, occurring when the P_H values fell below 4, was caused by a root fungus [unidentified] which was controlled by the addition of copper at the rate of 2 p.p.m. No correlation between P_H value or minor element composition and gummosis of the fruit could be determined.

ZENTMYER (G. A.), KLOTZ (L. J.), & MILLER (P. A.). **The pathological aspects of Avocado decline.**—*Calif. Citrogr.*, xxxi, 1, pp. 26–27, 1 fig., 1945.

During the past six or eight years, exceptionally heavy rainfall at intervals appears to have played an important part in increasing the prevalence of avocado 'decline' in California [*R.A.M.*, xxiv, pp. 188, 327]. Poor soil drainage would seem to be the chief factor in initiating the condition, though *Phytophthora cinnamomi* may also, perhaps, be of importance.

Seedlings in pots of soil taken from the immediate vicinity of affected trees made poor or no growth. When, however, other pots of the same soil were sterilized by steam, growth was excellent. Yet, when seedlings in sterilized soil were waterlogged for 10 to 14 days, they declined. This work is being repeated, with shorter periods of waterlogging, to determine if there are any differences between soil containing micro-organisms present round declining trees and soil from which these organisms have been removed by sterilizing. If not, it would seem that the presence of specific fungi or bacteria is not necessary for 'decline'.

Attempts at curing the condition by injecting the trees with vitamins, hormones, fungicides, and bactericides and by soil amendments have so far failed to give consistent results. In other experiments, seedlings have been replanted in areas where decline has occurred, after the soil has been given various treatments, but the results are not yet known.

The quick collapse and subsequent recovery of a large, healthy tree may be due to the sudden suffocation and poisoning of a large proportion of the feeder roots by waterlogging and accompanying anaerobic fermentations. Improved drainage or use of water in such cases permits the growth of new feeders and brings about recovery. With slow 'decline', however, recovery is usually impossible because of the extent of the root injury and of the difficulties, in many instances, of improving watering and drainage. Growers should see that their irrigation, fertilization, and other soil-management practices are such that they promote vigorous growth of the upper roots.

Woglum (R. S.). **High capacity boom sprayer.**—*Calif. Citrogr.*, xxxi, 1, p. 3, 3 figs., 1945.

A brief description is given of a high-capacity boom-sprayer [cf. *R.A.M.*, xxiii, p. 483], built by K. W. Loucks, for use on citrus trees. The 22-ft. boom carries 22 short Hardie guns arranged in two series set at different angles, both series being operated simultaneously in a vertical motion by a Briggs and Stratton motor. An independent 12-ft. stationary upright bears 10 'misto' nozzles for supplementary coverage in close-up work. A pressure of 500 lb. is maintained.

Under favourable conditions, the machine covers approximately two acres of 25-gal.-size trees per hour. Coverage is superior to any boom work yet seen.

Gruber (F.). **La bentonite, ses propriétés et ses applications.** [Bentonite, its properties and applications.]—*Bull. Inst. colon. Marseille. Mat. grasses*, xxv, 6, pp. 91–97, 1941. [Received December, 1945.]

In this paper the author discusses bentonite from various angles, including its industrial applications. He considers that there are in North Africa very suitable deposits of smectite clays from which bentonites of high quality could be obtained.

Verdoorn (F.). **Plants and plant science in Latin America.**—xxxvii+381 pp., 37 pl., 44 maps, 1945, Chronica Botanica Co., Waltham, Mass., U.S.A. $6.00 Wm. Dawson & Sons, London.

This volume provides, *inter alia*, a comprehensive survey of plant pathology and its practice in Latin America, together with a list of Latin-American plant science institutions, stations, and societies.

A. S. Müller (pp. 169–171) traces the foundation of plant pathology in Latin America to Speggazini in Argentina and Puttemans in Brazil; and, in a brief survey of institutions and their work, mentions researches into varietal resistance of sugar-cane in Campos, Brazil, Tucumán, Argentina, and Cuba; citrus diseases in Brazil; virus diseases of potato in Argentina; and the control of *Cercospora* blight of banana [*Mycosphaerella musicola*] in Central America. It is stated, however, that little attention is being paid to *Diplodia* ear rot of maize [*D. zeae*], anthracnose [*Colletotrichum lindemuthianum*], and rust [*Uromyces appendiculatus*] of beans in Brazil, Guatemala, and Venezuela, where losses from these diseases are high. The author notes a revival of interest in *Hevea* diseases in several countries and first studies of *Cinchona* diseases in Guatemala as further evidence of the great scope for plant pathology in Latin America.

J. B. Marchionatto (pp. 140–142) discusses the diseases of wheat and other cereals, including rice in Argentina, and outlines the organization of the phytopathological services of the Republic.

A. A. Bitancourt (pp. 302–304) records the chief crops of Brazil in order of importance as coffee, cotton, cacao, maize, cassava, sugar-cane, castor beans [*Ricinus communis*], citrus fruits, banana, tobacco, and rice. Brazil is almost free from any serious diseases of coffee and cotton. The establishment of the Instituto Biológico de Defesa Agricola and other research centres is noted and the problems of plant quarantine are briefly reviewed.

E. C. Stakman and J. G. Harrar (pp. 52–55) describe Mexico as a country with both temperate and tropical plant life, of such variety as greatly to complicate disease problems and make uniform approach to them impossible. Reluctance of farmers to use existing plant-pathological services causes widespread loss from maize smut [*Ustilago maydis*], rust [*Puccinia maydis*], and ear rots [*Diplodia zeae* and *Gibberella fujikuroi*], smuts of wheat [*U. tritici* and *Tilletia*] and barley, wilts of tomatoes [*Fusarium bulbigenum* var. *lycopersici*] and chilli peppers [? *F. annuum*], potato scab [*Actinomyces scabies*] and late blight [*Phytophthora infestans*], apple scab [*Venturia inaequalis*], bitter rot [*Glomerella cingulata*], and fire blight [*Erwinia amylovora*], and leaf-spot diseases of several plants. Spraying with Bordeaux mixture controls Sigatoka of bananas [*M. musicola*], which appeared in 1937 and threatened to destroy the industry [*R.A.M.*, xviii, p. 192]. Wheat rusts [*Puccinia* spp.] are typically epidemic. The control of *P. graminis*, the most destructive disease in Mexico and almost as dangerous to the United States and Canada, has become an international question.

R. D. Rands (pp. 182–199), and E. W. Brandes (pp. 199–201) offer complementary contributions on *Hevea* rubber culture. The use of selected clones resistant to leaf blight [*Dothidella* (or *Melanopsammopsis*) *ulei*] is suggested and the crossing of the best breeding, but highly susceptible eastern clones with the most resistant and highest-yielding Amazon selections recommended, and the three United States co-operative field stations and other research headquarters in Latin America are described. A list of clones recommended to breeding gardens is given. For commercial plantings Rands advises a mixture of Goodyear Far-Eastern and Ford Brazilian clones, respectively susceptible and resistant to leaf blight, and the former will require spraying in blight-infested areas until the trees are large enough for crown-budding with resistant material. Closely spaced mixed plantings of clones from these two groups provides insurance against blight, gives high initial yields and, with selective thinning, satisfactory production at maturity. Alternative suggestions include pure or solid plantings, in which each tree is crown-budded with highly resistant material, and trials with a rotational planting scheme. In order to provide constant supplies of blight-resistant, home-grown seed for the production of rootstocks the immediate setting-up of seed gardens in all co-operating countries is advocated.

C. W. Emmons (pp. 326–328) sees the importance of Latin America's contribution to the study of medical mycology in the fact that coccidioidal granuloma (*Coccidioides immitis*), rhinosporidiosis (*Rhinosporidium seeberi*), chromoblastomycosis (*Hormodendrum pedrosoi*), and paracoccidioidal granuloma [*Paracoccidioides brasiliensis*] were first studied in South America. The author observes that many parts of tropical America are still virgin territory so far as accurate knowledge of the incidence of mycoses is concerned.

Darlington (C. D.). **Introduction : the genetic analysis of disease.** Black (W.). **Inheritance of resistance to blight in Potatoes.** Cockerham (G.). **Some genetical aspects of resistance to Potato virus.** Jenkin (T. J.). **Diseases and pests at the Welsh Plant Breeding Station, Aberystwyth.**—*Ann. appl. Biol.*, xxxii, 3, pp. 279–281, 1945.

In a paper read at the Joint Meeting of the Association of Applied Biologists and of the Genetical Society held on Friday, 23rd March, 1945, C. D. Darlington pointed

out that the introduction of new resistant varieties or of new chemical protectives is followed and nullified by the appearance of new forms of pathogens. The natural variability of crop plants and stock has been destroyed, in the course of improvement by breeding during the past 50 years, by the fixation of relatively few strains and the natural host–parasite balance can no longer be maintained. The only remedy is the genetic one: the introduction of new variations and the regular replacement of short-lived clones.

On the subject of viruses, he mentioned Wallace's work [*R.A.M.*, xxiv, p. 131] showing the ability of tobacco to produce antibodies capable of indefinite self-reproduction in the tomato, which cannot produce them itself. These antibodies are introduced by grafting and not by the virus vector. They open up a fresh approach to the problem of controlling virus diseases.

W. Black amplified [ibid., xxiii, p. 147] an experiment in which the wild polyploid species, *Solanum demissum*, was employed as the source of resistant genes. Three strains of potato blight (*Phytophthora infestans*) were isolated, namely, A, commonly found in commercial crops, and B and C on plants known to be immune from strain A; these were tested with a mixed collection of hybrids, from which four resistant phenotypes were differentiated. All the resistant plants were immune from A, and the virulence in B and C proved qualitative rather than quantitative, indicating that these are physiologic forms pathogenically disposed to particular hereditary types of host plants.

An excess of susceptible seedlings in three groups of progenies appeared due to differential compatibility of the gametes of *S. demissum*, on the one hand, and of *S. rybinii* and potato on the other; blight resistance is essentially a *demissum* character and as long as it is retained some residual incompatibility may disturb the balance of segregation.

G. Cockerham drew attention to four genes, viz., Nx, which exercises a hypersensitive response to several strains of virus X, gene Nb, postulated as belonging to a series related to gene Nx, and controlling the hypersensitive response to virus XB, Na, also linked to gene Nx and determining hypersensitiveness to virus A, and Nc, a gene determining hypersensitiveness to virus C, a strain of virus Y. These four genes have been assembled in commercially acceptable varieties, though the inherent variability of individual viruses may cause the exercise of a selective effect of hypersensitive varieties in favour of aberrant virus strains, which have already been encountered, though rarely, in field-immune varieties, and there is no indication of their wide distribution even within those of such varieties as have been cultivated for 40 years.

A high degree of positive resistance to the leaf-roll virus has been found in three potato varieties, two of which are known to have 'wild' forms in their ancestry, and this resistance appears to be heritable and under genic control.

T. J. Jenkin, observing that the production of resistant strains of oats, clovers, and herbage grasses is the primary object of the Welsh Plant Breeding Station, recorded the production by selection from mixed populations of *Avena strigosa* of a variety, S.75, highly resistant to smuts [*Ustilago avenae* and *U. kolleri*], while S.171 represents a combination of S.75 with a relatively awnless grain type. Clover rot (*Sclerotinia trifoliorum*) has been the subject of special investigation. The heterogeneity of clover crops and the heterozygosity of individual plants, which made the choice of breeding material in clovers far wider, is still more characteristic of herbage grasses owing to the prolific wild material available for selection. This factor, the absence of attack in different areas and at different seasons, the association of resistance or susceptibility with age or stage of development of individual plants, and finally physiologic races complicate genetic study.

A condition resembling a virus disease has been found in old breeding material of perennial rye grass [*Lolium perenne*].

Quintanilha (A.). **La conduite sexuelle de quelques espèces d'Agaricacées.** [The sexual behaviour of some species of Agaricaceae.]—*Bol. Soc. broteriana*, Sér. 2, xix, 1, pp. 27–65, 22 diags., 1944.

In this paper, prepared for publication by J. Pinto Lopes [*R.A.M.*, xxi, p. 301; xxii, p. 396], separate lists are given of species of Agaricaceae of which (*a*) the spores germinated and yielded pure polyspore cultures, (*b*) the spores failed to germinate either on malt or dung, and (*c*) the polysporous mycelium produced no clamp-connexions. The sexual behaviour (heterothallism or homothallism) is described in a number of the many isolates under observation, mostly *Coprinus* and *Drosophila* spp.

Dillon Weston (W. A. R.). **American Gooseberry mildew. Potato leaf roll. Brown rot of Apples. Silver leaf disease.**—*J. Minist. Agric.*, lii, 2, pp. 71–82; 3, pp. 135–136; 4, pp. 176–178; 8, pp. 365–367, 4 charts, 1945.

Brief, popular accounts are given of American gooseberry mildew (*Sphaerotheca mors-uvae*), silver leaf of fruit trees (*Stereum purpureum*), brown rot of apple (*Sclerotinia fructigena*), and potato leaf roll, illustrated by charts [*R.A.M.*, xxiv, p. 305].

De Almeida (F.), Da Silva Lacaz (C.), & Ribeiro Do Valle (L. A.). **Flora micótica de alguns produtos alimentares.** [Mycotic flora of some foodstuffs.]—*Rev. Inst. Adolfo Lutz*, iii, 1, pp. 148–155, 1943. [English summary. Received October, 1945.]

The following were among the organisms isolated, mostly on Sabouraud's dextrose agar plus 2 per cent. tartaric acid, from 350 samples of various classes of foodstuffs at the Adolfo Lutz Institute, São Paulo, Brazil: fish, *Candida*; dairy products, *Torulopsis*, *Geotrichum*, *Mucor*, *Saccharomyces* (predominating in butter), *Rhodotorula*, and *Penicillium*; confectionery, *Rhizopus* and *Saccharomyces*; honey, *Aspergillus* and *Rhizopus*; beers, *Saccharomyces*, *Torulopsis*, and *Penicillium*; fruit syrups, *Saccharomyces* and *Torulopsis*; and miscellaneous cooling drinks, such as soda water, lemonade, ginger-beer, and the like, *Saccharomyces*, *Torulopsis*, *Picchia*, *Zygosaccharomyces*, *Geotrichum*, *Candida*, *Penicillium*, and *Rhizopus*. Altogether 60·4 per cent. of the liquid and 26·8 per cent. of the solid foods analysed were contaminated, and some general suggestions, based on factory hygiene and Government supervision, are made for the avoidance of microbiological spoilage.

Bryant (L. H.) & Smith-White (S.). **The rotproofing of jute hessian.**—*Fibres, Fabrics & Cordage*, xii, pp. 31, 33–34, 71–74, 1945. [Abs. in *Chem. Abstr.*, xxxix, 12, p. 2654, 1945.]

Over 2,500 tests were carried out on sand-filled bags treated with various chemicals to prevent rotting of the jute hessian. Copper oleate-creosote and copper thiocyanate gave the best results in respect of resistance to microbiological agencies and leaching, followed by copper acetate, which was further superior to all the other preparations in protection against sunlight weakening. The perenox, several cuprox, and basic carbonate treatments undergo extensive leaching over protracted periods and do not maintain their initially high protective action. These methods and perenox, moreover, are liable to 'dusting' in dry weather where the bags are subject to free movement: their chief advantages are ease of application and economy. Treatments proving unsatisfactory for various reasons included chromium tannin, cuprammonium, tannin-copper, and copper oleate in paraffin.

Giddings (V. P.). **Mildewproofing.**—*Amer. Dyest. Reptr*, xxxiv, 11, pp. 220–221, 1945.

The results of tests of treated cotton osnaburg and jute burlap samples by an accelerated soil-burial method, using a composted 'greenhouse' soil consisting of

sand, loam, and horse manure, outdoor weathering trials at New Orleans, Louisiana, and laboratory experiments involving inoculation with *Chaetomium globosum* before and after an accelerated weathering test of 360 hours' exposure in an Atlas single-arc weatherometer [*R.A.M.*, xxiv, p. 380], demonstrated the merits of copper compounds, notably copper naphthenate [see next abstract], cuprammonia, and copper ammonia fluoride.

Outdoor service tests on sandbags prepared from these materials generally confirmed the ratings of the treatments by accelerated methods, but some differences in the relative status of the three above-mentioned compounds were indicated, and the performance of some others, e.g., copper tallate, copper oleate, and copper resinate, was superior to that observed in the accelerated series. The addition of creosote to copper naphthenate and other copper treatments extended their service life in outdoor exposure experiments.

BARTLETT (A. E.) & GOLL (M.). **Does copper naphthenate oxidize cellulose?**—*Amer. Dyest. Reptr*, xxxiv, 12, pp. 225–227, 1945.

In a study of the catalytic effect of copper on the oxidation of cotton duck, cotton twine, and jute cordage, samples treated with copper sulphate or copper naphthenate [see preceding abstract] (depositing 0·6 per cent. metal on weight of fabric), alone or combined with additive (linseed oil and oxidation inhibitors in the case of the duck and pine tar with the twine and cordage), were exposed to oxygen at 115° C. and to ultra-violet light in the fade-o-meter and losses in tensile strength determined. Some of the samples were subjected to 3 per cent. sodium chloride to simulate the action of sea water before the application of the ultra-violet test, and others underwent 4½ months' exterior exposure at Elizabeth, New Jersey.

The results of the experiments indicate that tendering is promoted by copper sulphate but not by copper naphthenate, which in conjunction with the various additives actually conferred protection against oxidative degeneration as well as microbiological damage.

PRESTON (D. A.). **Host index of Oklahoma plant diseases.**—*Tech. Bull. Okla. agric. Exp. Sta.* 21, 168 pp., 1945.

This host index, first published in mimeographed form in 1939 and now brought up-to-date, gives information on the occurrence and distribution of 2,110 plant diseases so far recorded in Oklahoma.

BRIAN (P. W.) & HEMMING (H. G.). **Gliotoxin, a fungistatic metabolic product of Trichoderma viride.**—*Ann. appl. Biol.*, xxxii, 3, pp. 214–220, 1 fig., 1945.

Gliotoxin [*R.A.M.*, xxiv, pp. 68, 427] is shown to be a metabolic product of *Trichoderma viride*, and a semi-continuous apparatus for its production is described. The substance is moderately toxic to a wide range of bacteria, Actinomycetes, and fungi. *T. viride* is resistant to its own toxic effects. Applied as a dust to various seed-borne diseases, it is inferior to organo-mercury as a fungicide, and its control value is further restricted by the instability of aqueous solutions, except at low P_H.

DEY (N. C.). **A preliminary note on the antibacterial substance from Aspergillus flavus.**—*Curr. Sci.*, xiv, 10, pp. 265–267, 1945.

After pointing out that flavicin [cf. *R.A.M.*, xix, p. 723; xxiii, p. 267], extracted from *Aspergillus flavus*, is found to be innocuous [to man] after purification of the crude product, the author describes studies on an antibacterial substance obtained from a strain of the fungus which effectively inhibited *Staphylococcus aureus*.

Streptomycin. Method of preparation.—*Chem. Age, Lond.*, liii, 1375, p. 404, 1945.

Particulars of the production of the antibiotic streptomycin [*R.A.M.*, xxv, p. 6, and next abstract] have been supplied by C. R. Addinall (Assistant Director, Research and Development, Merck & Co.) in a special chemical supplement of *J. Commerce, N.Y.*, 10th September, 1945. A suitable medium for the growth of the soil Actinomycete yielding streptomycin, *Streptomyces* [*Actinomyces*] *griseus*, consists of 1 per cent. glucose, 0·5 per cent. peptone, 0·3 per cent. meat extract or 1·2 per cent. maize steep, and 0·5 per cent. sodium chloride. Agitation expedites the process of development. After five to ten days, streptomycin is isolated from the culture filtrate by adsorption on activated charcoal, the crude substance being removed by elution with acidified alcohol, and the eluate neutralized with sodium hydroxide. The addition of 10 vols. ether gives a highly concentrated solution of streptomycin. Its toxicity is described as 'rather low'. The therapeutic uses of streptomycin are likely to be directed primarily towards the cure of diseases caused by Gram-negative organisms, but it has also given promise of utility in connexion with certain members of the Gram-positive group.

Carter (H. E.), Clark (R. K.), Dickman (S. R.), Loo (Y. H.), Skell (P. S.), & Strong (W. A.). **Isolation and purification of streptomycin.**—*J. biol. Chem.*, clx, 1, pp. 337–342, 1945.

Methods are described for the isolation of streptomycin chloride from surface-culture filtrates of *Streptomyces* [*Actinomyces*] *griseus* [see preceding abstract] on a peptone-meat extract medium and purification of the crude material by a chromatographic process over alumina.

Gäumann (E.). **Immunreaktionen und Immunität bei Pflanzen.** [Immune reactions and immunity in plants.]—*Schweiz. Z. Path. Bakt.*, vii, 4, pp. 407–441, 22 figs., 1 diag., 3 graphs, 1944.

The author discusses the principles underlying the phenomenon of immunity from disease and its manifestations in man and animals on the one hand and plants [*R.A.M.*, xxii, p. 491] on the other, and illustrates them by concrete examples. Certain analogies between the human or animal and plant constitutions are recognized in regard to the mechanism, topological scope, and efficiency of the immune reactions, as well as in the duration of the protection conferred by sensitization, but in all these respects members of the animal kingdom enjoy advantages in kind or degree over those of the plant world. For example, in respect of the mechanism of immunity, certain plasmatic, biochemical reactions, e.g., the formation of agglutinins, lysins, virus antibodies, and the like, and a few histogenic demarcation responses are common to both man and plant, but the former possesses the capacity for phagocytosis and specific antitoxin development, denied to the latter.

Turning to the topological scope of immunity, besides the local, cellular reactions characteristic of both groups under discussion, man disposes of humoral defences against invasion in the form of the blood stream or the whole body. On the other hand, such possibilities of defence as are available to the plant are limited to the site of infection and its immediate environment, and are thus purely local.

Both man and plant may succeed in weakening and localizing the pathogenic agency, but the faculty of actually eliminating the intruder and so effecting a complete cure is an almost exclusively human attribute. The efficiency of immunity in plants must therefore be ranked as low.

With regard to the duration of the immunization acquired as a sequel to infection, man again occupies a favoured position, the protection thus conferred lasting in

some cases for a lifetime, whereas in plants it ceases with the disappearance of the pathogenic agency.

STEINBAUER (G. P.) & STEINMETZ (F. H.). **Eradication of certain Maine weeds, an important step in control of Potato diseases spread by aphids.**—*Misc. Publ. Me agric. Exp. Sta.* 602, 21 pp., 10 figs., 1945.

Full directions are given for the identification and destruction of various weeds growing in Maine which are known to harbour the aphid insect vectors of potato virus diseases [unspecified].

LIHNELL (D.). **Potatisviroserna och den Skånska Potatisodlingen.** [Potato viruses and Scanian Potato cultivation.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1945*, 3, pp. 36–39, 1945.

Scania and Halland are in the unenviable position of harbouring more potato viruses than any other part of Sweden, necessitating urgent attention to the problem of control. Not only do the diseases in question reduce yields and sometimes destroy entire crops, but Scania exports a considerable proportion of seed to other districts, thereby introducing the viruses to localities hitherto free from them. On a trip through western Scania in July, 1944, the writer counted in eight fields selected at random 0·5, 5, 12, 16, 21, 23, 29, and 100 per cent. diseased plants, respectively (not reckoning mild mosaic [virus X]). Leaf roll was present in seven of the fields to a varying extent. Streak [virus Y] (79 per cent.) occurred only in one field, which also contained 21 per cent. leaf roll. In 1943, 15 out of 32 fields (47 per cent.) inspected for seed production in the Malmöhus district were rejected on account of an excessive incidence of virus diseases, the corresponding figures for Kristianstad being 16 out of 61 (26 per cent.) and for the country as a whole 129 out of 571 (23 per cent.).

ELIASSON (S.). **Den lokala sortförsöksverksamheten. IV. Sammanställningar av resultaten av sortförsöken med Potatis under åren 1931 (1915)–1941.** [Local variety experimental work. IV. Summaries of the results of Potato variety trials during the period 1931 (1915) to 1941.]—*Medd. JordbrFörsöksanst. LantbrHögsk.* 10, 258 pp., 1 diag., 4 graphs, 1 map, 1944. [German summary.]

This fully tabulated survey of potato variety trials carried out in Sweden since 1914 embraces, *inter alia*, references to the reactions to certain diseases of some of the 66 varieties included in the trials. Up-to-Date proved to be highly susceptible to late blight [*Phytophthora infestans*] tuber rot and almost equally liable to foliar attack, comparable reactions having been shown by the early varieties, Early Puritan, Harbinger, and Eclipse (tested for tuber rot only), and the medium-early Trogs Lichtblick and Allerfrüheste Gelbe (both for tuber rot only). Some degree of resistance to tuber rot and moderate susceptibility to leaf blight was shown by the early Brita, fairly high resistance to both forms by the medium-early King George V and Majestic, the medium-late Gloria, Alpha, Magnum Bonum, and Erdgold (the first-named highly resistant to foliar infection), while the late Arran Consul and Ackersegen were highly resistant both to tuber and leaf infection, and Birgitta and Ovalgelbe fairly so (the latter tested for tuber rot only). Good keeping properties were shown by all the fodder and industrial varieties tested.

Up-to-Date was as susceptible to scab [*Actinomyces scabies*] as to tuber rot, and the early Brita and Early Puritan were only slightly more resistant. King George V was the best of the medium-early varieties in this respect, while of the medium-late ones, Alpha, Erdgold, and Jubel showed very fair resistance, while Gloria and King Edward VII were also superior to Up-to-Date. Ovalgelbe and Ackersegen were the most resistant of the late varieties tested, the former only on a small scale.

The following varieties are listed as immune from wart disease [*Synchytrium endobioticum*: *R.A.M.*, xxii, p. 274]: Aal, Dukker, Dunbar Yeoman, Frühmölle, Irish Cobbler, Juli, Arran Banner (early); Arran Banner, Dir. Johannsen, King George V, Majestic, Trogs Lichtblick (medium-early); Alpha, Ben Lomond, Erdgold, Frühgold, Jubel, Jämtlands Vit, Konsumragis, Leksands, Mittelfrühe (medium-late); Aaspotet, Ackersegen, Arran Consul, Ovalgelbe (late); Rosafolia, Ostbote, Parnassia, Sandnudel, Stärkeragis, Stärkereiche I, Voran, Wekaragis, Hellena, Hindenburg, Pepo, and Prisca (fodder and industrial).

RICH (A. E.). **Some factors affecting the yield and grade of Green Mountain Potatoes in Rhode Island.**—*Bull. R.I. agric. Exp. Sta.* 297, 19 pp., 1945.

Among the factors studied at the Rhode Island Agricultural Experiment Station in relation to Green Mountain potato production and quality in a series of trials from 1939 to 1944 was the effect of lime and hydrogen-ion concentration on scab (*Actinomyces scabies*). The plot receiving no lime yielded a much smaller proportion of diseased tubers than those given calcium oxide at total dosages of 3,000, 1,000, or 500 lb. per acre, the average percentages (1942–44) being 3, 25, 13, and 19, respectively, and the average P_H for the entire period covered by the tests 5·3, 5·1, 5·8, and 6·1, respectively. It will be noted that the plot most liberally supplied with lime and producing the largest number of scabby tubers was the most acid of the four, suggesting that the quantity of the soil amendment plays a more important part in the incidence of *A. scabies* than does the chemical reaction [cf. next abstract].

Advantages of small, whole seed over cut seed include a lower risk of the spread of such diseases as spindle tuber and bacterial ring rot [*Corynebacterium sepedonicum*] by means of the cutting knife, and of black leg [*Erwinia phytophthora*] through the agency of the seed corn maggot [*Hylemyia cilicrura*] feeding on the cut surface.

DE BRUYN (HELENA L. G.). **Aardappelschurft en vruchtopfolging.** [Potato scab and crop rotation.]—*Tijdschr. PlZiekt.*, xlix, 5–6, pp. 100–108, 1 pl., 1943. [English summary. Received November, 1945.]

In July, 1936, an experiment was begun at the Wageningen Phytopathological Institute to determine the effect of crop rotation on potato scab (*Actinomyces scabies*). Fifty pots containing infected soil were used, ten each being planted with wheat, grass, radish, clover, and Bintje potatoes. On lifting, all the potatoes were severely infected, both the deep and superficial types of scab [*R.A.M.*, xix, p. 41] occurring in nine of the pots and the latter only in the tenth. In 1937 Bintjes were replanted in three pots of each series, the remainder being sown with the same crops as in the preceding year. No clear-cut results developing in 1938, the experiment was continued with the original plants in all the pots for the next three years. By 1942, therefore, 12 pots had carried the same crop for four years, 28 for six years, and in 10 potatoes had been grown for six consecutive years. To terminate the investigation, five pots of each series were planted with Bintje and five with Eigenheimer tubers, the former variety being susceptible to both scab types and the latter only to the deep.

Superficial scab was most severe on Bintje and in the non-rotating series and when both types were present in the soil it tended to become predominant as time went on. In the wheat and grass pots there was little reduction in the incidence of infection, whereas after radish there was a marked decrease, though some scab occurred in all the pots. Deep scab was most virulent in the wheat and grass rotations. In the case of Eigenheimer, infection by this type was most severe after wheat, followed by potatoes and grass, negligible after clover and absent in the radish series.

The hydrogen-ion concentration of the soil in six pots of each series was determined. Although the incidence of infection did not invariably agree with the expectation of greater severity on alkaline than on acid soils [cf. preceding abstract] the mean P_H and the average amount of scab in each series corresponded reasonably well, except in the case of the more severe superficial scab on Bintje after potato monoculture, which presumably enhanced the virulence of the pathogen. In the spring of 1937 the P_H of the soil was 6·35, and at the time of these analyses it was 6·88 in the wheat series, 6·81 in potato, 6·63 in grass, 6·19 in radish, and 5·74 in clover. Two factors are believed to be jointly responsible for the differences in the incidence of scab in the various rotation schemes, (1) changes in the hydrogen-ion concentration of the soil following the cultivation of a given crop, and (2) modifications in the virulence of the parasite due to the presence or absence of potatoes in the succession. It is further suggested that the P_H requirements of the strain of *A. scabies* causing deep scab on Bintje and Eigenheimer are distinct from those needed by the one responsible for superficial scab on the former.

TEIGLAND (J.). **Dyrk kreftimmune Potetsorter.** [Cultivate wart-immune Potato varieties.]—*Småskr. LandbrDep., Oslo,* 88, 16 pp., 1 fig., 1945.

Experience in Norway has shown that the resting spores of potato wart (*Synchytrium endobioticum*) [*R.A.M.*, xix, p. 427] may retain their viability in the soil for a period of 15 to 16 years, so that the disease cannot be combated by the normal system of rotation, in which the same crop recurs at intervals of six to eight years. For this reason the cultivation of wart-immune varieties is strongly recommended and a descriptive list of those approved by the State Phytopathological Institute is given.

SMALL (T.). **Black scurf and stem canker of Potato (Corticium solani Bourd. & Galz.). Field studies on the use of clean and contaminated seed Potatoes and on the contamination of crop tubers.**—*Ann. appl. Biol.*, xxxii, 3, pp. 206–209, 1945.

In further experiments carried out by the author in 1943 and 1944 [*R.A.M.*, xxiii, p. 76] on black scurf and stem canker of potato (*Corticium solani*), the results of which confirm his earlier conclusions, black scurf was prevalent on crops from clean seed and not significantly different in amount from those raised from infected seed. It was severe on early-dug tubers but most severe on late-dug tubers. Crops with or without manure were heavily attacked. Contaminated seed caused a check to tuber formation and an increase in stem canker and in the number of primary shoots killed, but the yield from contaminated crops was satisfactory. The suggestion that black scurf may act as a pruning agent causing fewer but larger tubers to be produced was supported in the experiments conducted in 1943 but not in 1944, possibly owing to the May frosts of that year. The evidence obtained in four seasons from 1941 to 1944 shows that in this country good yields of early maincrop and maincrop varieties of potato may be produced in spite of the prevalence of *C. solani* in the soil and on the seed, provided the soil and cultural conditions are good. An experiment made in a field which had been grass at least 43 years suggested that in this case little, if any, *C. solani* was present in the soil. In another experiment heavy contamination occurred on tubers grown under dry soil conditions.

KOTILA (J. E.). **Rhizoctonia foliage disease of Hevea brasiliensis.**—*Phytopathology*, xxxv, 9, pp. 739–740, 1 fig., 1945.

Specimens of *Hevea* rubber leaves from the Agricultural Experiment Station, Tingo Maria, Peru, bore white, brown-bordered lesions ranging from 1 mm. in

diameter to blighted areas involving half or two-thirds of the leaf blade. The causal organism was found to be a *Rhizoctonia* characterized by brownish hyphae, 6·5 μ in diameter, and in the later stages by greyish-white, powdery masses of basidiospores, which measure 8·2 by 3·7 μ and are borne on sterigmata produced by terminal basidia (four on each). These characters agree with those of *Pellicularia filamentosa* [*Corticium solani*: *R.A.M.*, xxii, p. 372], but a distinctive feature of the rubber pathogen is the tight network of hymenial cells adhering with great tenacity to the leaf surface. On potato dextrose agar the mycelial mat is brownish-black and the substratum assumes a very dark coloration. The loosely textured sclerotia are 2 mm. in diameter. The perfect state has not been observed to develop on this medium. Inoculations on rubber seedlings at 21° to 25° C., with a relative humidity of 90 to 100 per cent., resulted in infection in five days, the perfect state appearing four or five days later. Leaf penetration was effected from minute infection cushions. Under comparable conditions the basidiospores were produced on sugar beet leaves in 10 to 15 days.

SEVERIN (H. H. P.). **Virus diseases of Guayule.**—*Phytopathology*, xxxv, 9, pp. 737–738, 1945.

Of a number of viruses tested for their pathogenicity to guayule [*Parthenium argentatum*], only those of tobacco mosaic and tobacco ring spot induced infection, the former causing small necrotic areas on the inoculated leaves only. In the latter case the inoculated plants acted as symptomless carriers of the disease.

KURZWEIL (H.). **Über das Verhalten von nativen und Kulturerdsporen im strömenden und gespannten Wasserdampf. Ein Beitrag zur Frage der Eignung dieser Sporen als Testobjekte bei der Dampfsterilisation.** [On the behaviour of natural and cultivated spores in streaming and superheated steam. A contribution to the question of the suitability of these spores as test objects in steam sterilization.]—*Z.Hyg. InfektKr.*, cxxiv, 1, pp. 1–70, 3 figs., 3 diags., 8 graphs, 1943.

Species of *Actinomyces* isolated from unmanured soil at the Graz (Austria) Hygienic Institute were experimentally shown to withstand 144 hours' exposure to steam at 100° C. and two minutes at 130°. This group of organisms was not represented in the manured soil samples, in which it was presumably held in check by an abundance of bacterial antagonists.

BEESON (K. C.). **The occurrence of mineral nutritional diseases of plants and animals in the United States.**—*Soil Sci.*, lx, 1, pp. 9–13, 3 maps, 1945.

Area patterns for the occurrence of boron, manganese, magnesium, zinc, copper, and iron deficiency diseases of plants are presented for the United States. In general, it is clear that the highly leached, acid soils of the Coastal Plains and the podzol group are most frequently associated with shortages of the minor elements and phosphorus, which may also be absent from an extensive western zone. Copper deficiency on muck and other soils with a high organic content probably constitutes a special problem. A perusal of experiment station reports and other published references to plant deficiencies disclosed the following numbers of allusions to each element: boron 489, manganese 257, zinc 248, copper 189, magnesium 125, and iron 107.

CAMP (A. F.). **Zinc as a nutrient in plant growth.**—*Soil Sci.*, ix, 2 pp. 157–164, 1945.

Much of the work critically surveyed by the writer on the pathological effects of zinc deficiency on plants has already been noticed in this *Review*.

STEINBERG (R. A.). **Use of microorganisms to determine essentiality of minor elements.**—*Soil Sci.*, lx, 2, pp. 185–189, 1945.

The mineral requirements of *Aspergillus niger* agree with those of the green plants except in respect of calcium, silicon, and boron, and it can therefore be used as a test organism for minor element studies [*R.A.M.*, xxiv, p. 284] when accuracy, speed, and precision are necessary, or in cases demanding aseptic or extremely pure conditions.

MOORE (R. H.). **Mineral deficiencies in Derris elliptica.**—*Bull. P.R.* [*fed.*] *agric. Exp. Sta.* 43, 26 pp., 5 figs., 1 graph, 1945.

This paper describes an investigation using sand cultures of nutrient deficiencies affecting *Derris elliptica* [cf. *R.A.M.*, xx, p. 226], which in Puerto Rico sometimes shows mild pathological symptoms. Occasionally the leaves are slightly bleached by the direct rays of the mid-day sun even in the rainy season; the combination of drought, direct sunlight, and wind may desiccate the tips of young leaves; drought causes some new leaves to change from red to yellow and then gradually to green, while the potential chlorophyll-bearing tissue bordering the distal part of the principal veins sometimes turns green so slowly that the leaves acquire a 'white-vein' appearance; minute, brown spots develop on some young leaves formed late in the dry season, but do not appear on new leaves formed after the spring rains have stimulated a growth flush; in some cases the basal part of the blade develops chlorophyll faster than the distal part; and occasionally new leaves fall when still small and unopened.

None of the nutrient elements studied showed these conditions to be due to a lack of any one of them. The checking of root growths common to all mineral deficiencies was most severe in the treatments lacking potassium, phosphorus, or calcium. Specific patterns of chlorosis appeared in leaves of all deficiencies except nitrogen, potassium, and calcium.

WEBB (A. H.) & TANNER (F. W.). **Effect of spices and flavouring materials on growth of yeasts.**—*Food Res.*, x, 4, pp. 273–282, 4 figs., 1945.

Cinnamon was the most effective of the spices tested for their capacity to inhibit yeast growth [cf. *R.A.M.*, xxiii, p. 184] in dextrose broth cultures, six out of eight species, including the refractory *Oidium* [*Oospora*] *lactis* and *Saccharomyces hansenii*, being completely suppressed at a dilution of 1 in 100. Clove and allspice [*Pimenta officinalis*] exerted a preventive influence on some of the organisms, the latter controlling *O. lactis* at 1 in 50. At 0·1 per cent. by weight, the same three spices markedly retarded but did not suppress yeast growth. *Monilia candida* [*Candida vulgaris*] and *Mycoderma lactis* survived contact with anise and wintergreen oils, which were lethal to other organisms.

FORBES (I. L.) & MILLS (P. J.). **Movement of mosaic virus through Sugar-Cane seed pieces.**—*Phytopathology*, xxxv, 9, pp. 705–713, 1 fig., 1945.

Sugar-cane is propagated in Louisiana by planting whole stalks or portions thereof, each such seed piece usually giving rise to a number of shoots. From inoculation experiments covering the period from 1942 to 1944 it was ascertained that the mosaic virus can spread from an infected shoot through the old seed piece to other shoots, movement occurring in either direction. It is also capable of traversing a node and attacking other shoots further distant from the point of infection. In 1942, 29 out of 50 plants of two varieties, C.P. 28/19 and C.P. 28/70, contracted the disease, and in ten the virus spread from inoculated to uninoculated shoots. In 1943, 17 out of 55 Co. 281 plants inoculated with the virus developed mosaic, and in 6 the infective principle travelled to a total of 9 other shoots; in the

case of C.P. 28/70, mosaic occurred in 18 out of 45, and the virus spread from 8 inoculated to 14 uninoculated plants apparently through the seed pieces. In four tests in 1944 (two each on the same varieties as in 1943), transference of the virus in the manner under discussion took place in 14 out of 20, 13 out of 19, 6 out of 21, and 3 out of 25 seed pieces, respectively.

ABBOTT (E. V.). **The relation of the occurrence of foliage symptoms of chlorotic streak of Sugar Cane to the distribution of the virus in the plant.**—*Phytopathology*, xxxv, 9, pp. 723–736, 2 graphs, 1945.

Sugar-cane plants affected by chlorotic streak in Louisiana [*R.A.M.*, xxiv, p. 291] become symptomless through the loss by senescence of the streaked leaves and the temporary or permanent absence of signs of the disease in the foliage produced subsequently. Less frequently, foliar recovery was effected by the restoration of the normal green colour in the faintly chlorotic zones of diseased leaves.

Generally speaking, the extent of bud infection was correlated with the severity of foliar symptoms, and was greater in persistently streaked plants than in those showing temporary or permanent recovery. Loss of leaf symptoms, however, did not necessarily connote the disappearance of the virus from the stalks; in some plants the presence of infection in the buds was established several months after the foliar streaks became invisible. Some buds from diseased stalks produced apparently sound plants on germination. Presumably this was the result of actual recovery from chlorotic streak, though it is possible that those particular buds were not involved or not with sufficient inoculum to induce the characteristic symptoms. A tendency was observed for the buds on the upper stalk segments to be freer from the disease than those on the lower ones.

The varieties under investigation differed in the amount of shoot and bud infection, possibly as a result of the more restricted movement of the virus or a greater degree of recovery in some than in others. Such disparities did not correspond with the relative susceptibility to infection of the several varieties. C.P. 807, for instance, which is about equally susceptible with C.P. 28/19, recovered from foliar symptoms to a much larger extent than the latter, and the virus was present in a lower percentage of the secondary shoots and lateral buds; similar observations have been made in respect of C.P. 29/320 and C.P. 29/103.

The stalk rather than the stool was found to be the physiological unit concerned in the distribution and migration of the virus through the plant, the infective principle appearing in or disappearing from individual stalks independently of the rest of the stool. The removal of the infected primary shoot from a cane stool with initially healthy secondary shoots led to a noticeable increase in the number of diseased secondary shoots, probably correlated with the movement of reserve materials into them from the underground part of the stem of the infected primary shoot. This affords a plausible explanation of the higher incidence of chlorotic streak in ratoons than in plant cane.

CARVAJAL (F.). **Phoma terrestris on Sugar Cane roots in Louisiana.**—*Phytopathology*, xxxv, 9, p. 744, 1945.

From 1942 to 1944, *Phoma terrestris* was isolated a number of times from sugar-cane roots in Louisiana, as well as from those of onion, garlic, *Melilotus indica*, and maize [*R.A.M.*, xxiii, p. 261], and from cane, rice, and cotton soils. The cultural and morphological characters of all the strains were uniform, and the identity of the fungus was confirmed by Dr. E. C. Tims. All the isolates readily produced the pycnidial state on potato dextrose agar at room temperature in subdued daylight. The cells of maize roots inoculated with fragments of cultures from cane, onion, garlic, and maize and incubated in the dark at room temperature for

7 to 15 days were often found to be completely filled by the mycelium, which imparted a red-brown coloration to the tissues. The endodermis offered strong resistance to the entry of the fungus. Some of the infected roots acquire a stiff consistency and flaccidity was not usually observed.

QUANJER (H. M.). **Bijdrage tot de kennis van de in Nederland voorkomende ziekten van Tabak en van de Tabaksteelt op kleigrond.** [Contribution to the knowledge of the Tobacco diseases occurring in Holland and of Tobacco cultivation on clay soil.]—*Tijdschr. PlZiekt.*, xlix, 3–4, pp. 37–51, 3 pl., 1943. [Received November, 1945.]

Tobacco is affected in Holland by the widespread tobacco mosaic virus and various fungal diseases, including damping-off (*Pythium* spp.), a leaf blight caused by *Botrytis* [? *cinerea*], and less commonly but more severely by sclerotial rot [*Sclerotinia sclerotiorum*]. More destructive than any of the foregoing, however, is a second virus disease known by growers as 'partridge' ['patrijs'] and 'rattle' ['ratel'], which in 1942 was specially prevalent on the light soils of the Maas and Waal valleys. The form of the disease termed 'partridge', from its resemblance to the wings of this bird, is confined to the foliage and recalls the American [tobacco] ring-spot virus; the more serious 'rattle', suggestive of the trouble known in France as 'canker' [*R.A.M.*, xii, p. 489] and in Germany as 'mauke' [scab.: ibid., xvii, p. 205], is characterized by inverted spoon-shaped leaves, bearing many necrotic spots, which burst and rattle when touched, the foliar lesions extending as brownish-grey streaks into the stems. It was experimentally shown that the agent of 'partridge' and 'rattle' persists in the soil of the seed-bed and possibly in that of the field. A number of questions concerning the disease remain unanswered, but in the meantime three practical measures aiming at the joint control of mosaic and 'partridge' and 'rattle' are recommended, viz., washing the hands in trisodium phosphate and soap before beginning work in the tobacco beds and after handling infected plants [ibid., xxiii, p. 44 *et passim*], seed-bed disinfection by steam sterilization, and a change-over to new fields.

Important contributions to the literature on mosaic and 'partridge' and 'rattle' are summarized, the latter having been fully investigated in Germany by Böning under the name of 'stripe and curl disease' [caused by a strain of the tobacco-streak virus: ibid., x, p. 562]. In a preliminary test at Wageningen the expressed sap of 'partridge' and 'rattle' plants retained its pathogenicity after a ten-minute exposure to a temperature of 70° C. but not after the same time at 80°. All the tobacco varieties and selections grown in the Leeuwen experimental garden were susceptible to 'partridge' and 'rattle', this having also been Böning's experience in Bavaria.

Delacroix, who originally described 'canker' from France (*Ann. Inst. nat. agron., Paris*, Sér. 2, v, p. 141, 1906), observed that both the foliar and stem symptoms were much more prominent in damp seasons, the latter, in fact, not appearing at all in dry weather, while a similar relationship was noticed in the Maas and Waal valleys in the rainless summer of 1941 and the wet one of 1942.

KAUSCHE (G. A.) & RUSKA (H.). **Über den Nachweis des Tabakmosaikvirus in den Chloroplasten viruskranker Pflanzen.** [On the detection of the Tobacco mosaic virus in the chloroplasts of virus-diseased plants.]—*Naturwissenschaften*, xxviii, 19, p. 303, 1 fig., 1940. [Received December, 1945.]

The more or less pronounced injury to the chloroplast apparatus of the host associated with the total-reacting type of tobacco mosaic [*R.A.M.*, xx, p. 279] led to a search for a possible relationship between the chloroplast substance and the virus protein. The first indication of such a connexion was afforded by the

observation, under the Siemens ultra-microscope, of rod-shaped molecules of the virus protein on isolated chloroplast grains from diseased plants, which were absent from healthy material. Tests on *Datura stramonium* with chloroplast suspensions from virus-diseased tobacco plants showed that destruction of the chloroplasts is necessary to release the active substance and induce a positive reaction. Both quantitative studies on the virus content of the chloroplasts and electronic-optical observations denote a definite affinity, probably of a chemical nature, between the protein components of the chloroplast substance and the virus protein.

GRIEVE (B. J.). **Studies in the physiology of host-parasite relations. 1. The effect of Bacterium solanacearum on the water relations of plants.**—*Proc. roy. Soc. Vict.*, N.S., liii, 2, pp. 268–299, 1 pl., 1 diag., 2 graphs, 1941. [Received December, 1945.]

In studies on the effect of *Bacterium* [*Xanthomonas*] *solanacearum* [*R.A.M.*, xxi, p. 91, 1942] on the water relations of tomato and potato plants, particularly in relation to speed of infection and the development of leaf epinasty and wilting, it appeared that transpiration in infected and control plants made parallel progress until several leaves of the infected plants showed epinasty and uni- or bilateral wilting. As more leaves became affected, the rate of transpiration gradually fell. In spite of a considerable reduction in the healthy leaf surface during the earlier stages of wilting, evidences were found of a high rate of transpiration in infected plants, a result similar to that obtained in experiments on healthy plants in which successive leaves were vaselined. The rate of water loss, therefore, may be maintained in spite of the reduction of available leaf area ranging up to 33 per cent. in the experiments so far reported.

It was demonstrated that the progress of absorption in relation to invasion is closely similar to that of transpiration under the same conditions. Where the parasite was inoculated at the stem apex, no reductions in absorption took place before the bacteria had overrun and 'blocked' several root vessels after growing downward through those of the stem, and the results of the author's experiments, which included eosin transport and histological tests, indicate that the wilting of the leaves is due to this mechanical obstruction and not to the presence of tyloses, gums, or toxins.

PLATTNER (P. A.) & CLAUSON-KAAS (N.). **Über ein Welke erzeugendes Stoffwechselprodukt von Fusarium lycopersici Sacc.** [On a wilt-producing metabolic product of *Fusarium lycopersici* Sacc.]—*Helv. chim. Acta*, xxviii, 1, pp. 188–195, 1945.

A very detailed account is given of the writers' analytical studies at the Federal Technical College, Zürich, on the metabolic product of *Fusarium* [*bulbigenum* var.] *lycopersici* shown in a previous paper [*R.A.M.*, xxiv, p. 479] to be capable of inducing wilt in tomatoes.

PLATTNER (P. A.) & CLAUSON-KAAS (N.). **Über Lyco-marasmin, den Welkstoff aus Fusarium lycopersici Sacc.** [On lyco-marasmin, the wilt-inducing substance from *Fusarium lycopersici* Sacc.]—*Experientia*, i, 6, pp. 195–196, 3 figs., 1945. [English summary.]

A hypothetical formula is given for 'lyco-marasmin', the name proposed to designate the tomato wilt-inducing substance isolated from cultures of *Fusarium* [*bulbigenum*] var. *lycopersici* [see preceding abstract]. It yields on hydrolysis glycine, aspartic and (probably) pyruvic acids, and ammonia.

WALSH (T.) & CLARKE (E. J.). **Iron deficiency in Tomato plants grown in an acid peat medium.**—*Proc. Roy. Irish Acad.*, B, l, 13, pp. 359–372, 1945.

A mottled chlorosis of the young upper foliage of tomato plants due to iron deficiency and similar to that previously controlled by a 0·25 per cent. aqueous spray of iron sulphate has been observed for some years in various parts of Eire. In experiments designed to investigate the factors responsible for the chlorotic condition it was found that analysis of foliage and fruit showed chlorotic plants having a much lower content of iron than normal ones. The affected plants had more magnesium than healthy specimens and a lower phosphorus content, were unthrifty, and bore subnormal fruit. This iron deficiency occurred in a strongly acid peat medium containing sufficient readily soluble iron, the suggested explanation of the anomaly being an impaired root activity of the plant, consequent on an increase in acidity and water-soluble zinc, a relatively high concentration of which was present in chlorotic specimens [*R.A.M.*, xix, p. 143]. It was also found that liming and phosphate dressings decreased the amount of water-soluble iron in the peat, but this was not thought to be of sufficient magnitude to cause the chlorosis and the need for further study is indicated.

SLEETH (B.) & LORENZ (R. C.). **Strumella canker of Oak.**—*Phytopathology*, xxxv, 9, pp. 671–674, 1 fig., 1945.

In the autumn of 1934, branches ¼ to 3 in. in diameter of white, chestnut, red, scarlet, and black oaks (*Quercus alba, Q. montana, Q. borealis* var. *maxima, Q. coccinea,* and *Q. velutina*) were inoculated at the Logan State Forest, Pennsylvania, with *Strumella corynoidea* [*R.A.M.*, xiii, p. 605] by Hahn and Ayers's method [ibid., xvii, p. 422]. In May, 1935, the fungus was recovered from 12 out of 14 inoculated branches, in December of the same year from a further 9 out of 11, in May, 1937, from 5 out of 8, and in October of the same year from all 6 specimens, making a total of 32 positive reisolations. By May, 1937, many of the inoculated branches were showing definite signs of canker formation, the pathogen in most cases having killed the branch and progressed downwards, sometimes as far as the trunk, and it is reasonable to suppose that natural infection takes place in a similar manner.

In June, 1937, three scarlet and three red oak branches inoculated in Connecticut in the previous October also yielded *S. corynoidea* in culture.

Cross-inoculation tests in the Pennsylvania plot failed to provide any evidence of physiologic specialization within the fungus.

JACQUES (J. E.). **Un chancre de l'Orme de Sibérie (Ulmus pumila) causé par Nectria cinnabarina.** [A canker of the Siberian Elm (*Ulmus pumila*) caused by *Nectria cinnabarina.*]—*Ann. Ass. canad.-franç. Sci.*, x, p. 89, 1944.

The Siberian elm (*Ulmus pumila*), chiefly used in Quebec for the planting of hedges, is a preferential host of *Nectria cinnabarina*, which gains ingress through dead branches, mostly near the base, and penetrates a large limb or more often the trunk, where it destroys the cambium and cortex and forms a canker. Ultimately the invaded branch or stem is completely girdled and all the upper part starved. On account of this serious disease the cultivation of the Siberian elm should be discontinued.

TYLER (L. J.) & PARKER (K. G.). **Factors affecting the saprogenic activities of the Dutch Elm disease pathogen.**—*Phytopathology*, xxxv, 9, pp. 675–687, 1 fig., 1 graph, 1945.

The effects of temperature and moisture on the saprophytic growth and survival capacity of six distinct cultural races of *Ceratostomella ulmi* [*R.A.M.*, xxiv, pp. 344,

435] were studied at Cornell University [cf. ibid., xix, p. 310]. The optimum temperature for coremiospore germination was found to be about 27° C., with a satisfactory range from 21° to 30° and only a trace at 12°, 15°, 18°, and 33°. At least three factors appear to be implicated in the somewhat erratic germination of these organs, namely, racial idiosyncrasy, age (10- to 15-day-old coremia providing the best material), and nutrition, technical-grade being superior to chemically pure maltose for this purpose. S. A. Pope's unpublished data denote the indispensability to *C. ulmi* of pyridoxin [cf. ibid., xxiii, pp. 311, 312] and certain minor elements, which may possibly be present in the original product and disappear in the course of purification. A similar temperature range favoured mycelial growth on potato dextrose agar, except that the minimum was lower (3°). At unduly high or low temperatures the colonies were white in contrast to the normal pale greyish-cream, while aerial (*Cephalosporium*) conidiophores were also poorly developed or absent under the former conditions. On elm wood disks mounted on non-nutrient agar coremia grew best at 24°. One race produced these organs at a range of 3° to 30°, while in another two races they failed to develop at any of the temperatures tested.

The coremiospores germinated in profusion at relative humidities of 98 and 100 per cent., but not at or below 95. Firmly established in the form of mycelium and spores in diseased elm wood, the fungus spread over the surface at relative humidities of 92 per cent. and upwards, but at 96 per cent. or lower it did not grow on sound wood planted with spores. At 92 per cent. growth was very scanty, at 96 fair, and at 98 and 100 abundant.

C. ulmi survived for at least two years in infected elm wood protected against rapid loss of water and abnormally high temperatures, i.e., stored in an open container at −3°, buried in the sand floor of an outdoor screen-covered cage to a depth of half the diameter of the sections, or kept in an open container and exposed alternately for a week at a time to temperatures of −10° and 15°. On the other hand, it succumbed in six months in specimens stored in an open container about 6 ft. above the floor of a rain-proof shed. The inability of the fungus to survive rapid and prolonged drying, even in wood, is a character that renders it vulnerable.

Buchwald (N. F.). **Bør nye Douglasie-Kulturer anlaegges i Øjeblikket?** [Should new Douglas Fir plantings be established at the moment?]—*Dansk Skovforen. Tidsskr., 1940*, pp. 521–527, 1 map, 1940. [Received November, 1945.]

With reference to the detection of the Douglas fir [*Pseudotsuga taxifolia*] 'soot fungus' (*Phaeocryptopus gaeumanni*) in eight localities in Denmark (four in Jutland, one in Fünen, and three in Zealand) [*R.A.M.*, xviii, p. 826], the writer recapitulates the measures recommended in Germany for the control of the disease and suggests the adoption of a similar procedure. This would involve the absolute rejection of seed for new plantations from the infected areas at any rate, and preferably from the whole of Denmark, pending studies on the resistance to the parasite among the several types of Douglas fir.

Nattrass (R. M.). **A canker of Cupressus macrocarpa in Kenya caused by Monochaetia unicornis.**—*E. Afr. agric. J.*, xi, 2, p. 82, 1 pl., 1945.

Examination of the cankers found on *Cupressus macrocarpa* near Nairobi and resembling those caused by *Coryneum cardinale* [*R.A.M.*, xxiv, p. 39] showed the presence of fructifications of a species of *Monochaetia* identified by Mr. E. W. Mason as *M. unicornis* and *Pestalotia funerea*. Inoculations of young *Cupressus macrocarpa* trees with cultures of both organisms showed *M. unicornis* to be an active parasite, causing cankers which girdled and killed the part of the tree above them. No cankers resulted from inoculations with *P. funerea*.

Van Vloten (H.). **Verschillen in virulentie bij Nectria cinnabarina.** [Variations in virulence in *Nectria cinnabarina*.]—*Tijdschr. PlZiekt.*, xlix, pp. 163–171, 4 figs., 1 diag., 1943. [English summary. Received November, 1945.]

The results of inoculation experiments with two monospore (ascospore and conidium) isolates of *Nectria cinnabarina* from *Acer pseudoplatanus* on five *A. platanoides* [*R.A.M.*, xvi, p. 217] trees, in three of which the roots were wounded by cutting to a depth of 20 to 25 cm., showed that the fungus makes rapid progress during the growing season (April to July). The optimum temperature for the growth of the fungus on cherry agar was 22·5° C. In the case of the ascospore isolate the spread of the fungus introduced through wounds penetrating to (*a*) the cambium and (*b*) the xylem (six tests each) extended on an average $14\frac{1}{4}$ and 21 mm., respectively, the corresponding figures for the conidium isolate being 86 and $141\frac{1}{2}$ mm., respectively, with four cases of branch die-back, which did not occur in the ascospore series. On the trees with wounded roots the ascospore isolate spread for a distance of 15 mm. compared with 20 mm. on those with an intact root system, the corresponding figures for the conidium isolate being 128 and 90, respectively, with one and four cases of branch die-back, respectively. It is apparent from these data that the two isolates, though both producing typical bark cankers, differed appreciably in the extent of their parasitism, which in the case of the ascospore isolate was much more limited than in that of the conidium, 42 per cent. of the inoculations with the latter, in fact, causing die-back in the first season. Discrepancies in previous reports on the pathogenicity of *N. cinnabarina* [ibid., ix, p. 119] may thus be attributable to the existence of different strains within the species.

Lutz (L.). **Sur les conditions de production de gommes solubles et insolubles.** [On the conditions of production of soluble and insoluble gums.]—*C.R. Acad. Sci., Paris*, ccxviii, 19, pp. 766–767, 1944.

In connexion with the production of pathological gums by trees attacked by lignicolous fungi [*R.A.M.*, xv, p. 540], the question arose why certain hosts secrete soluble and others insoluble substances. To settle this point, various wood samples from trees normally secreting either one or the other type of gum were inoculated with a number of indigenous French wood-destroying fungi. *Acacia verek* inoculated with *Xanthocrous* [*Polyporus*] *hispidus* and *Leptoporus* [*P.*] *adustus*, *A. seyal* with *P. adustus* and *Trametes gibbosa*, *A. mollissima* with *P. hispidus*, beech with *Fomes fomentarius* and *Daedalea quercina*, and *Robinia pseud-acacia* and plane [*Platanus* sp.] with *Polyporus hispidus* all secreted insoluble gum, in some cases accompanied by traces of a soluble substance. On the other hand, the inoculation of *A. verek* with a fungus of foreign origin, *Asterula gummipara*, resulted in the production of soluble gum. Comparable observations were made, and described in a communication to the Society of Pharmacy of Paris on 3rd May, 1944, when wild cherry wood was inoculated with *A. gummipara* and various native fungi, including *Stereum purpureum*. The substance secreted by the samples infected by *A. gummipara* underwent rapid and complete solubilization, *S. purpureum* caused slow and partial liquefaction, while the other organisms tested were almost entirely inactive in this respect.

It would thus appear that the quality of the gum secreted by an infected tree is a property of the parasitic fungus rather than a botanical attribute of the host.

Buckman (S. J.), Browne (R. Y.), & Gay (W. H.). **Nonpressure treatment of wood. III. Solvents, equipment, and methods for the treatment of wood with low viscosity oil solutions of pentachlorphenol.**—*Sth. Lumberm.*, clxxi, 2146, pp. 35–42, 2 figs., 3 diags., 9 graphs, 1945.

There were two previous papers in this series, viz., I. Cold soaking treatment of Southern Pine sapwood with a low viscosity oil solution of pentachlorphenol, by

S. J. Buckman and J. D. Pera, and II. Soaking treatment of reheated Southern Pine sapwood with a low viscosity oil solution of pentachlorphenol, by the same authors and R. Y. Brown in *Sth. Lumberm.*, clxv, 2081, pp. 223–226, 4 graphs, 1942; clxvii, 2105, pp. 156–158, 4 graphs, 1943. The present study deals in a highly technical manner with the points mentioned in the title.

McKnight (T.). **Plant protection. Diseases of root crops.**—*Qd agric. J.*, lxi, 3, pp. 152–158, 5 figs., 1945.

Brief, popular notes are given on the symptoms and control of the following diseases of root crops in Queensland; carrot leaf blight (*Macrosporium* [*Alternaria*] *carotae*) [*R.A.M.*, xxiv, p. 303] and leaf spot (*Cercospora apii-carotae*) [*C. carotae*: loc. cit.], carrot and beet crown rots, of which the two most common forms are due to *Sclerotium rolfsii* [ibid., xx, p. 195; xxi, p. 399] and *Rhizoctonia* sp., and storage rots (chiefly *Rhizopus nigricans* [*R. stolonifer*], *Botrytis* sp., and *Fusarium* sp.), beet leaf spot (*C. beticola*) [ibid., xxiv, p. 87], sometimes causing very heavy losses, and turnip blackleg (*Phoma* sp.) and white rust (*Albugo candida*) [*Cystopus candidus*: cf. ibid., xx, p. 78].

Jacobsen (B.). **Studies on Olpidium brassicae (Wor.) Dang.**—*Medd. VetHøjsk. plantepat. Afd., Kbh.*, 24, 53 pp., 7 pl., 1943. [Received November, 1945.]

Following a survey of previous contributions to the knowledge of *Olpidium brassicae* [*R.A.M.*, xviii, p. 821], the author fully describes his studies on the fungus in Denmark, where it was isolated at the end of May, 1940, from swede roots growing in soil infested by club root (*Plasmodiophora brassicae*). The principal differences between *O. brassicae* and *O. radicicola* (syn. *Asterocystis radicis* and *Olpidiaster radicis*) [ibid., viii, p. 282] include the longer zoosporangial necks in *O. brassicae*, measuring up to 50 μ, and the irregular, globose or ellipsoid, nodular resting sporangia contrasting with the uniformly stellate shape of the same organs in *O. radicicola*. Of some 1,000 zoosporangia of *O. brassicae* isolated from inoculated plants of *Alyssum calycinum*, *Arabis alpina*, swede, black mustard (*Brassica nigra*), *B. oleracea*, *Capsella bursa-pastoris*, wallflower (*Cheiranthus cheiri*), garden cress (*Lepidium sativum*), *Matthiola annua*, and charlock (*Sinapis arvensis*) [*B. sinapistrum*], 57 per cent. were globose, ranging from 9 to 27 μ in diameter, and 43 per cent. elongated, measuring 24 to 252 by 12 to 36 μ. The resting sporangia, indistinguishable in the early stages from the zoosporangia, measure at maturity 9 to 24 μ in diameter when globose or 21 to 30 by 12 to 15 μ for the ellipsoid forms.

The results of the writer's inoculation experiments did not bear out the conclusions of Woronin (*Jb. wiss. Bot.*, xi, pp. 548–574, 1878) and others as to the ability of *O. brassicae* to cause damping-off; none of the infected plants sustained appreciable damage and the retardation of growth was inconsiderable. In addition to the above-mentioned species, positive results were obtained on turnip, *B. elongata*, various types of cabbage, cauliflower, kale, Brussels sprouts, *B. juncea*, *Hesperis tristis*, *Lunaris biennis*, *Raphanus raphanistrum*, radish, *Thlaspi arvense*, and among non-crucifers, *Atriplex patulum*, beet, *Chenopodium album*, cucumber, lettuce, flax, tomato, tobacco, and *Solanum nigrum*, peas, and red clover (*Trifolium pratense*) became infected, but the sporangia failed to mature, as was also the case in the monocotyledons tested (except oats). There is thus no doubt that crucifers are the hosts of choice of *O. brassicae*, which has been found in nature in various parts of Denmark on swede, turnip, cabbage, cauliflower, *Capsella bursa-pastoris*, *R. raphanistrum*, beet, and *Chenopodium album*. Beet roots also yielded a fungus presumed to be *Ligniera junci* [*R.A.M.*, xiii, p. 60], a new record for the country.

Walsh (T.) & Cullinan (S. J.). **Investigations on marsh spot disease in Peas.**—*Proc. Roy. Irish Acad.*, B, l, 15, pp. 279–285, 1945.

The authors describe the occurrence in Galway in 1943 of marsh spot disease [manganese deficiency] of peas [*R.A.M.*, xxiv, p. 173], which has probably been present in Eire for many years, as ideal soil conditions for its development exist in various parts of the country. The affected plants showed a mottled chlorotic appearance and characteristic symptoms in the seeds.

In experiments laid down in Galway dressings of manganese sulphate at ½ cwt. per acre controlled the chlorosis effectively and the 'marsh-spot' condition to some extent (33 per cent. diseased as compared with 60 in untreated soil). In pot experiments using six varieties, spraying with 1 per cent. manganese sulphate solution at flowering time gave complete control in each case and increased the manganese content of the seed, while there was only one case of foliar damage from spraying. Laxton's Superb showed a mottled chlorosis and considerable crinkling of the flowers, while Onward showed slight chlorosis. The seeds of Blues and Laxton's Superb were unaffected and Marrow Fat, Alderman, Onward, and Giant Stride showed, respectively, up to 18, 16, 60, and 57 per cent. infection.

No differences were found in the manganese content of diseased and healthy peas from the same pods.

Burkholder (W. H.). **The longevity of the pathogen causing the wilt of the common Bean.**—*Phytopathology*, xxxv, 9, pp. 743–744, 1945.

Recent tests have shown that the agent of bean wilt (*Corynebacterium flaccumfaciens*) [*R.A.M.*, ix, p. 695] can live for 24 years in association with the seed of its host under room conditions. In 1919 a handful of diseased White Marrow bean seed was stored in a screw-top glass container and placed on a laboratory shelf at Cornell University, New York. Inoculation tests on Red Kidney beans after 15, and again after 20 years with isolates from three of the seeds in each case proved that the bacteria were still pathogenic. After 24 years, in 1943, one out of three seeds yielded viable and virulent cultures, but in 1944 none of the ten remaining seeds produced active inoculum.

According to C. W. Rapp (*Science*, N.S., l, p. 568, 1919), *Xanthomonas phaseoli* did not retain its viability in two- and three-year-old bean seed, and Christoff found the same organism non-viable in seven-year-old material [*R.A.M.*, xiv, p. 341]. The author is not aware of any observations on the longevity of the causal organism of halo blight, *Pseudomonas* [*medicaginis* var.] *phaseolicola*.

Hubbeling (N.). **De invloed van de uitwendige Omstandigheden bij het optreden van Boonenziekten.** [The influence of external factors on the occurrence of Bean diseases.]—*Tijdschr. PlZiekt.*, xlviii, 11–12, pp. 225–234, 5 pl., 1 graph, 1942. [English summary. Received November, 1945.]

The influence of the abnormal weather conditions prevailing at Wageningen, Holland, during the summer of 1941 on the development of bean diseases was studied in the field and laboratory. The season was characterized by low temperatures and sharp night frosts in the first half of May, a low June and July rainfall with high maximum day temperatures, sometimes exceeding 35° C., a cool, damp August and a dry, sunny September.

Deficiency diseases, notably a brown discoloration of the leaf margins, interveinal chlorosis, and stunting associated with a shortage of potassium, were conspicuous in June and July but barely perceptible later.

Aphid-borne viruses, especially those of bean mosaic and bean yellow mosaic, were also much in evidence during the same period, when the warm, dry weather favoured the multiplication of the vectors. On the other hand, 'stipple streak'

(possibly identical with *Nicotiana* virus 11 [tobacco necrosis: *R.A.M.*, xvi, p. 637; xviii, p. 211] or consisting of a mixture of viruses) was masked to some extent during the hot spell, but in August produced typical reddish-brown ring spots on the pods. All the races of *Phaseolus vulgaris* so far tested for their reaction to tobacco necrosis have proved susceptible, only *P. multiflorus* having been resistant in the laboratory.

Grease spot [*Pseudomonas medicaginis* var. *phaseolicola*: ibid., ix, p. 696] was very prevalent on Ceka brown beans in August, more than half of most of the crops being infected and over 25 per cent. of the pods bearing lesions.

Rust (*Uromyces appendiculatus*) was of little importance, since the cool, humid conditions conducive to the germination of its spores only developed at the close of the season. Quite the reverse was the case with anthracnose (*Colletotrichum lindemuthianum*), which encountered a favourable atmosphere while the plants were still in the seedling stage, and after a temporary set-back due to better conditions for the host in June and July, reappeared in a virulent form with the renewal of damp, cool weather in August. A similar course was pursued by the so-called 'leaf spots', *Ascochyta boltshauseri* and *A. phaseolorum*, which also cause heavy stem and pod infection [ibid., ix, p. 273], and the foot rots associated with *Fusarium* sp., *Sclerotinia sclerotiorum*, and *Botrytis cinerea*.

Booer (J. R.). **Experiments on the control of white rot (Sclerotium cepivorum Berk.) in Onions.**—*Ann. appl. Biol.*, xxxii, 3, pp. 210–213, 1945.

This paper gives an account of the work on which the author's previous report of promising results obtained by applying mercurous chloride to the seed drill for the control of *Sclerotium cepivorum* was based [*R.A.M.*, xxiv, p. 219]. Four localized soil treatments are described, A (control), B, C, and D, wherein 1 lb. 4 per cent. calomel [mercurous chloride] dust and 96 per cent. finely divided siliceous filler were applied through seed drills and mixed with soil sown with James Keeping onion seed per 100, 50, and 25 yd. drill, respectively. The percentage infection in the four treatments after thinning and after harvest were 92, 43, 22, and 17, and 38, 49, 29, and 21, respectively, and the yield of sound onions 1·58, 4·40, 5·95, and 7·90 tons per acre, respectively. In treatment B, equivalent to about 5 lb. mercury per acre, the effective mercury concentration probably fell below the required minimum at an early stage of the experiment owing to the formation of mercuric sulphide. Treatment C, equivalent to the application of 10 lb. mercury to the soil, maintained a concentration effective up to the time of harvesting salad onions, but treatment D, at 20 lb. per acre, proved sufficient to provide an effective concentration throughout the trial, and demonstrated that localized soil treatment is much more efficient than broadcast applications at equal dosages of mercury [cf. ibid., xvii, p. 717].

Hellmers (E.). **Botrytis on Allium species in Denmark. Botrytis allii Munn and B. globosa Raabe.**—*Medd. VetHøjsk. plantepat. Afd., Kbh.*, 25, 51 pp., 2 pl., 20 figs., 2 graphs, 1943. [Received November, 1945.]

Botrytis neck rot of onions due to *B. allii* is stated to be prevalent on onions in storage in Denmark, where *B. byssoidea* has been detected only three times on leek and twice on onion seed, according to P. Neergaard (5. and 7. Aarsberetning fra J. E. Ohlsens Enkes Plantepatologiske Laboratorium, 1940, 1942) [cf. *R.A.M.*, xxiii, p. 427], and *B. squamosa* is not known to occur. *B. allii* has been observed by the author on the Ailsa Craig, Blood Red Dutch, Yellow and Red Pear-Shaped, and Yellow and Red Zittauer onion varieties and on winter shallots, forming a grey mould, 1 mm. in height, interspersed with black, circular sclerotia, 1 to 5 mm. in diameter; the diseased bulbs turn brown and develop a soft rot. Wounds are the principal channels of ingress of the fungus.

Typical cultures of *B. allii* develop on potato dextrose and onion agar. For optimum growth the fungus requires a high relative humidity (95 to 100 per cent.) and a temperature of 20° to 25° C., but reasonably good results are obtained at a lower degree of moisture and a temperature range of 5° to 29°. The range for spore germination extends from 3° to 27°, with an optimum at 19° to 27°. The septate, faintly smoky-grey mycelium consists of hyphae of variable diameter, mostly 6 to 8 μ, with characteristic haustorioid protuberances both in nature and in culture, which are also formed to a lesser extent on the septate, erect, branching conidiophores, 10 to 18 μ in diameter; the faintly smoky-grey, ellipsoid to ovoid or globose conidia, 4·5 to 18 by 4 to 8 (average 9·2 by 6) μ, produced in clusters, arise from sterigmata on the swollen branch tips and emit one germ-tube, occasionally two; globose, hyaline microconidia, 3 μ in diameter, may be found in old cultures. Pale green, later blackish-green to deep black appressoria, composed of thick, twisted hyphae, are readily formed on the glass walls of culture tubes and may produce large, thick, sclerotioid crusts, but on subculturing they give rise exclusively to hyphae. Black appressoria also develop on the bulb surface, while in the tissues they occur as pale, tangled hyphal bundles, some distance behind the edge of the necrotic zone.

In culture the flat, circular sclerotia measure 1 to 4 mm. in diameter and 1 to 2 mm. in height, but on the host, as mentioned above, individual sclerotia forming part of the hard, convoluted crust may reach 5 mm. in diameter and 3 mm. in height. Hyphae or conidiophores or both may arise from the sclerotia. The pathogen produces pectinase, cellulose, and oxalic acid.

A species of *Botrytis* found on *Allium ursinum* in two localities was found to agree with Raabe's description of *B. globosa* on garlic in Germany [ibid., xviii, p. 140].

In preliminary inoculation experiments with the *B.* spp. under discussion on Yellow and Red Zittauer onions and shallots, positive results were given by *B. allii* and *B. globosa* from Danish sources and a culture of the former from the Bureau voor Schimmelcultures, Baarn, Holland, whereas *B. cinerea* of the former and *B. squamosa* and *B. byssoidea* of the latter origin were non-pathogenic. In another series of tests with *B. allii* on the same hosts, using bulbs (1) with scales, (2) without scales, (3) wounded, and (4) aretan-treated, the results in respect of (1) and (4) were uniformly negative, and in the case of (2) and (3) all positive. Aretan exerted a definitely toxic action on *B. allii*, the hyphae of which were scorched on the surface before coming into contact with the tissues. In another experiment plants sprayed with Bordeaux mixture (2-2-100) before inoculation with a spore suspension of *B. allii* showed no sign of infection three weeks later, whereas the wounded and unwounded, unsprayed controls showed virulent and slight infection, respectively. Since field plants are rarely without lesions, preventive applications of Bordeaux mixture, especially to the 'heart' and in humid seasons, are advisable. Other control measures, besides those already indicated in connexion with the experimental data, should include removal and destruction of onion refuse after harvesting, clean and rational culture in open, well-drained soil with plenty of lime, and early sowing; the practice of breaking the top to expedite ripening is undesirable.

WALLACE (E. R.) & HICKMAN (C. J.). **The influence of date of lifting and method of storing on loss of Onion bulbs harvested in 1943.**—*Ann. appl. Biol.*, xxxii, 3, pp. 200–205, 1 fig., 1945.

This paper is based on an examination at Kirton, Lincolnshire, and Perdiswell, Worcestershire, of the effect of indoor and outdoor storage on the incidence of storage losses of onions, and notably of neck rot, one of the most serious diseases of *Allium cepa*. *Botrytis allii* is commonly the cause of neck rot in Britain, but a

fungus agreeing with *B. byssoidea* was isolated in England by Croxall and Pickford in 1943; *B. squamosa* has not yet been found in this country on onion bulbs, although located by Hickman and Ashworth [*R.A.M.*, xxiii, p. 161] on onion foliage. Apart from neck rot, account had to be taken in the Kirton and Perdiswell experiments of storage losses due to eelworm (*Anguillulina dipsaci*) and premature sprouting.

Ailsa Craig, Bedfordshire Champion, Unwin's Reliance, and Up-to-Date varieties of seed from the same stocks were used and the onions were harvested between 26th July and 16th September at intervals of three weeks, dried, and stored at Kirton indoors and at Perdiswell partly indoors and partly out.

The Kirton crop was examined five times between 5th October and 27th March, and the Perdiswell crop four times between 1st November and 29th February. The increase in crop weight at the season of growth was considerably greater at Kirton than at Perdiswell. Although at both places the later the bulbs were lifted the greater became the incidence of loss observed after storage, the final results differed greatly. Whereas at Kirton the surviving yield was lowest from the first lifting in every variety tested, at Perdiswell the original order of crop weights was entirely reversed. Neck rot was the chief agent of loss, premature sprouting came next, followed by eelworm.

The general result of the comparisons made showed that there is no great difference in losses from *Botrytis* spp. developing in or outdoors, but outdoor storage largely reduced the losses due to sprouting and eelworm. Although there was evidence that the proportion of loss increased with later lifting, earlier lifting offered no solution to the problem of *Botrytis* loss, because the loss from the first liftings was high. The results at Perdiswell encourage the suitable storage of onions in the open, since no increase in loss occurred thereby, but whatever general similarity there may have been in storage losses at both centres, the comparisons between earlier liftings, which determine the saleable residue at any given time, and later liftings were so different as to show the unwisdom of applying the results of local experiments to general practice.

BEATTIE (W. R.). **Lettuce growing.**—*Fmrs' Bull. U.S. Dep. Agric. 1609*, 29 pp., 20 figs., 1940.

In a revised edition of this bulletin, first published in 1929, notes are given on some of the major lettuce diseases of the United States. Downy mildew of lettuce [*Bremia lactucae*: *R.A.M.*, xxiv, p. 398] is widespread, but in the east occurs mostly in greenhouses, while on the Pacific coast it sometimes attacks New York-type field plants. The problem of control is complicated by the fact that lettuces, highly resistant at one time, may, if grown at another, or in a different locality, be attacked by a different physiologic form of mildew, to which it shows acute susceptibility. The wild lettuce [*Lactuca canadensis*] should be eradicated from proximity to lettuce fields and greenhouses, as it is also susceptible to *B. lactucae*. Crop rotation is advised and the spraying of young plants with Bordeaux mixture checks the disease during early growth and may considerably reduce its virulence.

VASUDEVA (R. S.) & PAVGI (M. S.). **Seed transmission of Melon mosaic virus.**—*Curr. Sci.*, xiv, 10, pp. 271–272, 1 fig., 1945.

When a number of different cucurbits were raised in sterilized soil in an insect-proof glasshouse and regularly sprayed with soap and nicotine sulphate twice a week, one melon plant developed symptoms of infection by a virus which was presumably seed-transmitted. The disease was successfully conveyed by mechanical means to a number of Solanaceous plants, and the reactions on differential hosts indicated that it was caused by a strain of *Cucumis* virus (Doolittle) [cucumber mosaic virus].

DOOLITTLE (S. P.) & HARTER (L. L.). **A graft-transmissible virus of Sweet Potato.**—*Phytopathology*, xxxv, 9, pp. 695–704, 1945.

In 1942 a sweet potato plant propagated from a root received from the U.S.S.R. in 1934 was observed at Beltsville, Maryland, to be affected by a virus disease causing an unusual type of feathery yellowing of the foliage and considerable stunting of the plants, but no pronounced distortion of the leaves or necrosis of any part. No further plants of the Russian sweet potato or of the many other varieties included in the trial plots where the observation was made showed similar symptoms, but the virus was transmitted by stem-grafting and the insertion of plugs of diseased root tissue into healthy roots of Nancy Hall, Porto Rico, Triumph, Wennop, and some unnamed selections. Negative results were given by experiments in other modes of transmission and cross-inoculation tests; no insect vector has yet been discovered, nor have the chemical or physical properties of the virus been determined. The name proposed for it is 'feathery mottle of sweet potato' or *Flavomacula ipomeae* according to McKinney's system of classification [*R.A.M.*, xxiii, p. 427].

TRESCHOW (C.). **The Verticillium diseases of cultivated Mushrooms.**—*Dansk bot. Ark.*, xi, 1, pp. 1–31, 5 figs., 1 graph, 1941. [Received September, 1945.]

A new disease of the cultivated mushroom, *Psalliota hortensis* Cooke forma *avellanea* sensu Lange [*R.A.M.*, xxiii, p. 87], was first observed near Copenhagen in the summer of 1939, during a sudden spell of excessively hot weather, when it was impossible to keep the temperature below 22° C. The growth of most of the fruit bodies was completely and finally suppressed, while the pilei of those that did develop bore a profusion of irregular spots of varying shades of brown. When a second flush of mushrooms was produced in fresh soil, more than half soon became discoloured, while about half the remainder assumed an asymmetric habit, with a greatly swollen base, a small pileus, and a tendency to horizontal growth. A few of the spotted mushrooms left standing produced luxuriant aerial mycelium. Eventually the fructifications shrivelled and acquired a leathery consistency. Most of the fruit bodies constituting the third flush, six days later, shrivelled at an early stage, but the number of discoloured ones was much smaller than in the preceding crops. The cultures were disposed in flat beds, partly on the brick floor and partly on wooden shelves at a height of 1·3 m., on which infection was much more severe than on the ground.

The fungus isolated from the diseased fruit bodies made rapid growth on several standard media at 20°. On 4 per cent. malt agar it produced a pure white mycelium composed of septate, branched, repent hyphae, 1 to 2 μ in diameter, erect, septate conidiophores, usually with verticillate branches, 1 to 2 μ in diameter; the verticils in the main axis number 1 to 10 and consist of 1 to 4, generally 2 or 3 phialides, 18 to 30 by 1 to 1·5 μ, tapering slightly towards the apex and septate at the base. The conidia, 6 to 10·5 by 2 to 3·5 μ, are abstricted singly from each of the phialides, a distinctive feature of the former being their transversal attachment to the phialide by the longitudinal axis, with the apices turned inwards towards the hypha.

Irregular, mostly bicellular chlamydospores were also observed. The fungus is considered to be a new species, to which the name of *Verticillium psalliotae* is assigned.

The very exceptional mode of conidial development in the mushroom parasite was closely studied in comparison with that of the nearly related *V. malthousei* [ibid., xxii, p. 160] and *Cephalosporium costantinii* [ibid., xiv, p. 346]. In the case of *V. psalliotae*, the detachment of phialides in the conidiophores begins long before the conidiophore has ceased to elongate and a phialide usually attains its

full length in five to six hours, when conidial formation commences, almost coinciding with the onset of development of the next phialide in the whorl. The conidium of the phialide first formed, originally globose, becomes elongated-oval, tapering slightly at both ends. On the completion of the process of phialide and conidial formation, there was no change in the picture for a period of two days, the conidia remaining attached to the phialides (some extraneous stimulus appears to be required to disconnect them) and no new phialides appearing in the whorl. In *V. malthousei* and *C. costantinii*, on the other hand, new conidia are produced continuously, the old ones either being abstricted or clusters of individuals aggregating. In inoculation experiments the two *V.* spp. caused serious damage only at temperatures above 20°, and their pathogenicity was confined to the brown strain, whereas *C. costantinii* also attacked the white one and developed actively at 20°. In this connexion it is pointed out that *C. lamellicola* [ibid., iv, p. 167] is also capable of infecting both the brown and white strains, whereas *Mycogone perniciosa* and *M.* sp., the sole agents of the 'môle' disease [ibid., xvi, p. 15], are restricted to the latter.

The optimum temperatures for the growth of *V. psalliotae*, *V. malthousei*, *C. costantinii*, and *M. perniciosa* were shown by comparative experiments under controlled conditions to be 23°, 22°, 20°, and 22°, respectively, at which levels they produced, respectively, 283, 268, 229, and 400 mg. dry matter in a month. None of the four species developed at 8°, but *V. malthousei* and *C. costantinii* made slight growth at 10°, all except *M. perniciosa* were still producing mycelium at 30°, and *V. psalliotae* even survived at 35°. These results are in fair agreement with those of the above-mentioned inoculation tests, in which *C. costantinii* caused 90 per cent. infection on intact mushrooms at 20° and *V. malthousei* 40 per cent., whereas *V. psalliotae* was innocuous below 22°. The optimum hydrogen-ion concentrations (original) for *V. psalliotae*, *V. malthousei*, *C. costantinii*, and *M. perniciosa* were determined as P_H 6·7, 5·6, 5·6, and 6·7, respectively. None of the fungi grew at P_H 2·2, but all were still producing mycelium at 7·4 at the close of the experiment.

V. psalliotae secreted a red pigment in synthetic media enriched with glutamic acid and deprived of ammonia. In comparative experiments on natural substrata, this species made vigorous growth on horse manure, which it completely permeated in a fortnight. *C. costantinii* also developed actively on the same medium, though not to the same extent as *V. psalliotae*, while the growth of *M. perniciosa* and *V. malthousei* was superficial. On soil the growth of *V. psalliotae* was also luxuriant, though largely confined to the surface.

Irrigation of the casing soil with a 2 per cent. solution of calcium hypochlorite gave satisfactory control of *V. psalliotae*.

El cultivo de los hongos comestibles en la Argentina. [Mushroom cultivation in Argentina.]—*Rev. argent. Agron.*, xii, 3, pp. 246–248, 3 pl., 1945.

An account is given of the successful commercial production of mushrooms (*Agaricus* [*Psalliota*] *campestris*) by a company in Buenos Aires. The beds are disposed in houses built of masonry, 30 by 6 m., each house having six beds on wood arranged in two stacks separated by an alley-way and the mushrooms being cultivated at temperatures and with air-conditioning suited to their growth.

Morel (G.). **Le développement du mildiou sur des tissus de Vigne cultivés in vitro.** [The development of mildew on Vine tissues cultivated *in vitro*.]—*C.R. Acad. Sci., Paris*, ccxviii, 1, pp. 50–52, 1 fig., 1944.

Fragments of young Aramon vine shoots were placed in a synthetic nutrient solution and after a month's growth inoculated with conidia of *Plasmopara viticola* from diseased leaves in water drops. Six days later the surface of the vine tissue

fragments were observed to be covered with the typical conidiophores of the fungus. Oospore formation was not detected. The experimental material was devoid of chlorophyll, contradicting the current opinion that the parasite only attacks the green tissues. At a temperature of 20° C. subcultures had to be made at monthly intervals, transferring a certain number of conidia to fresh vine tissues, in order to maintain the fungus in a viable condition.

NYSTERAKIS (F.). **Phytohormones et court-noué de la Vigne.** [Phytohormones and 'court-noué' of the Vine.]—*C.R. Acad. Sci., Paris*, ccxxi, 2, pp. 53–55, 1945.

In order to study the possible influence of phytohormones on the development of vine court-noué [*R.A.M.*, xxiv, p. 441], the writer in May, 1944, planted healthy roots of three varieties in three media, viz., garden soil, sand, and spring water, with the addition of indole -β- acetic acid at dosages ranging from 0 to 800 mg. per l. water. In the two tests on soil, the length of the largest stem of the vines receiving 250 mg. of the heteroauxin was 22 cm., the number of internodes 21, and the mean length of the internodes 1·44 cm. compared with 120 cm., 24, and 5·15 cm., respectively, for the untreated; in two on sand (in darkness) the corresponding figures for the treated (400 mg.) and untreated plants were 44 cm., 15, and 3·03 cm. and 190 cm., 27, and 6·35 cm., respectively; in two on the same substratum (in daylight) 9 cm., 10, and 0·75 cm. and 50 cm., 13, and 3 cm., respectively; and in eight in water, the maximum stem length, number of internodes, and mean length of the internodes in the treated vines ranged from 2·5 cm. (800 mg. indole-β-acetic acid) to 22 (0·015), 3 to 14, and 0·60 cm. (10 mg.) to 1·57, the corresponding figures for the untreated being 46 cm., 15, and 2·85 cm., respectively. Other well-known symptoms of the disease, including adventitious stems, various foliar malformations, and a zig-zag arrangement of the internodes, were also observed in the treated vines. Disequilibrium of the hormones resulting from some pathological factor would thus appear to be the immediate cause of court-noué.

KALMUS (H.) & KASSANIS (B.). **The use of abrasives in the transmission of plant viruses.**—*Ann. appl. Biol.*, xxxii, 3, pp. 230–235, 1 pl., 1945.

In tests with tobacco-mosaic virus, tomato bushy-stunt virus, potato virus X, and tobacco-necrosis virus, celite, animal charcoal, and carborundum [*R.A.M.*, xxiii, p. 363] were equally effective in increasing the number of lesions, except that some preparations of carborundum and charcoal reduced infectivity. The incorporation of 400-mesh carborundum, the most effective grade, with the inoculum has the effect of increasing the dilution end point of a given virus preparation by 100 times, and when virus concentrations are small gives an effect in local-lesion tests equivalent to increasing the virus content by 100 times. The authors consider it probable that the viruses normally difficult to transmit by the inoculation of infected sap, but which are easily transmitted by the use of an abrasive, are those that occur in infective sap at or below the dilution end point required for their respective hosts. It is significant that all these viruses have been occasionally transmitted without the use of an abrasive, whereas the beet curly-top virus, which is believed not to be transmitted mechanically, is not assisted by abrasives because it requires to be inserted directly into the phloem [ibid., xiii, p. 674]. The apparent effect of abrasion is similar to increasing the virus content, but as this is impossible it may be assumed that it acts by weakening the resistance of the host. It may be that abrasives, by increasing the lesions made by trituration, make access to the host by virus organisms easier.

The ammoniacal silver hydroxide test carried out by the authors strikingly illustrates the very serious effect of abrasives on the leaf. This reagent turns black

in the presence of light when it reacts with any reducing substance. Unwounded leaves of *Nicotiana glutinosa*, tobacco, potato, sugar beet, and lettuce when placed in the reagent remain unaffected. But leaves rubbed with the forefinger become stippled with black spots; and when leaves rubbed with abrasives are treated, they show even blackening, probably owing to the removal of the outer waxy layer which may facilitate the entry of the virus. At the same time, a further experiment showed that leaves rubbed with abrasives recovered their resistance to infection by sprayed virus within three hours, although they continued to give the argentaffin test for days after being rubbed. Damage to the semi-permeable system of rubbed leaves seems, therefore, quickly reparable, but injury to the cuticular layer which prevents the entry of salts cannot be repaired.

It may also be that abrasives affect different cells from those affected by ordinary rubbing and that the two types of cells differ in their susceptibility to infection. Dilute inocula may possess too few virus particles to ensure that all points of entry are penetrated, or the type of cell involved may be resistant to all but mass inoculum. Trichomes, as well as the cuticular layer, are removed by rubbing, but they may require greater initial virus attack than the epidermal leaf cells, in which case the effect of abrasives may lie in exposing these more susceptible cells which are usually resistant to rubbing.

FERDINANDSEN (C.). **Arbejdet ved Tilsynet med Plantesygdomme.** [Work connected with plant-disease inspection.]—Reprinted from *Tidsskr. Landøkon.*, *1942*, 27 pp., 1942. [Received November, 1945.]

In this lecture on the functions of plant disease-inspectors delivered at the Agricultural College, Copenhagen, on 27th October, 1942, it is stated that of the diseases at present subject to legislation in Denmark, potato wart (*Synchytrium endobioticum*) [*R.A.M.*, xxiv, p. 401] is the only one of practical importance; the existing regulations concerning it [ibid., xviii, p. 704] are summarized and explained. A brief note is given on the interpretation of the Order of 27th March, 1903, providing for the exclusion of barberries from nursery-gardens as a means of combating cereal black rust [*Puccinia graminis*; ibid., vi, p. 21]. Strictly speaking, the restriction applies to all species of barberry, but in practice it is now enforced solely in the case of *Berberis vulgaris*, its hybrids and varieties, and five other species, on which there have been only two records of infection during the present century.

Distribution maps of plant diseases.—Maps 73–96. Issued by the Imperial Mycological Institute, 1945. 3*s*. 9*d*.

The fourth year's issue of this series of maps showing the world distribution of major crop diseases [*R.A.M.*, xxiv, p. 128] comprises (No. 73) *Phoma lingam* on swede, turnip, and cabbage, (74) *Cercosporella herpotrichoides* on wheat and other cereals, (75) *Neovossia horrida* on rice, (76) *Peronospora destructor* on onion, (77) *Cladosporium fulvum* on tomato, (78) *Aphanomyces euteiches* on peas, (79) *Ustilago scitaminea* on sugar-cane, (80) *Urocystis tritici* on wheat, (81) *Guignardia bidwellii* on vine, (82) *Marssonina panattoniana* on lettuce, (83) *Phytophthora erythroseptica* on potato and tulip, (84) wheat mosaic virus on wheat, (85), *Pseudomonas medicaginis* var. *phaseolicola* on beans (*Phaseolus*), (86) *Bremia lactucae* on lettuce, endive, chicory, etc., (87) *Phakopsora vitis* on vine, (88) *Polyspora lini* on flax, (89) *Alternaria solani* on potato, tomato, etc., (90) *Claviceps paspali* on *Paspalum* spp., (91) *Ceratostomella fimbriata* on *Hevea* rubber, coconut, sweet potato, cacao, etc., (92) *Ophiobolus miyabeanus* on rice and other *Oryza* spp., (93) *Ustilago maydis* on maize, (94) phony-peach virus on peach, (95) sugar-cane sereh disease virus on sugar-cane, and (96) *Cercospora beticola* on beet.

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RODRIGUEZ SARDIÑA (J.). **Notas sobre viroses. II. La clasificación de los viruses. III. Tres conferencias del Doctor Bawden.** [Notes on viroses. II. The classification of viruses. III. Three lectures by Dr. Bawden.]—*Bol. Pat. veg. Ent. agríc., Madr.*, xiii, pp. 115–134, 11 figs., 1944.

Part I of the author's study entitled 'The present status of the virus problem', appeared in *Bol. Pat. veg. Ent. agríc., Madr.*, x, pp. 33–38, 1942. In part II he discusses the various systems of classification that have been proposed for the accommodation of the viruses, with special reference to those of Holmes [*R.A.M.*, xix, p. 229] and Ruska (*Arch. Virusforsch.*, ii, 5, pp. 480–498, 1943). Part III is a summary of three lectures delivered by Dr. F. C. Bawden in Lisbon in February, 1945, the first dealing with the control of the damage caused by viruses, the second with the effects and characteristics of viruses, and the third with their structure and properties.

BENLLOCH (M.). **Nueva enfermedad de las Judías Phaeoisariopsis griseola (Sacc.) Ferr.** [A new Bean disease, *Phaeoisariopsis griseola* (Sacc.) Ferr.]—*Bol. Pat. veg. Ent. agríc., Madr.*, xiii, pp. 27–32, 4 figs., 1944.

A visit to Vélez in the province of Málaga revealed the presence on beans (*Phaseolus vulgaris*) of *Phaeoisariopsis* [*Isariopsis*] *griseola*, of which there appear to be only two previous records for Spain [cf. *R.A.M.*, xvi, p. 564; xxiv, pp. 206, 476]. The conidia produced by the Málaga isolates were mostly triseptate, measuring 39·2 to 70 by 5·6 to 7 μ, while the extreme limits ranged from 28 to 31·8 by 5·6 to 8·4 μ (uniseptate) to 67·2 to 80·3 by 5·6 to 8·4 μ (quinqueseptate). Infection over a small area may be combated by the burning of diseased material at the first sign of attack, but fungicidal treatments are requisite for more extensive foci. Copper-containing mixtures have proved unsatisfactory for this purpose, and experiments with preparations of another kind are planned.

NUSBAUM (C. J.). **A preliminary report on internal cork, a probable virus disease of Sweet Potato.**—*Plant Dis. Reptr*, xxix, 25/26, pp. 677–678, 1945. [Mimeographed.]

The observation of dark, hard, corky spots on the flesh of the Porto Rico variety of stored sweet potato at Edisto Experiment Station, Blackville, South Carolina, coincided with a similar disorder reported from Barnwell and Orangeburg counties, on stock being removed from storage and packed for market. Several pieces of seed roots which exhibited internal cork spots were bedded and the sprouts planted in the field for observation in 1944. As the flesh symptoms bore some resemblance to boron deficiency of garden beet, experimental plots were also established on limed and unlimed soils, supplied with five levels of boron through applications of 0, 5, 10, 20, and 30 lb. of borax per acre.

Late in the 1944 season indistinct purple ring-spot symptoms were observed generally on the older leaves of plants grown from corky seed and to a less extent in other plantings at the Edisto Station. At harvest internal cork was observed

on roots of plants showing ring spot. Failure to isolate an organism from corky tissue of freshly dug and stored roots caused the possibility that a culturable pathogen was involved to be set aside, and the fact that ring spot and internal cork symptoms occurred indiscriminately throughout the borax treatments eliminated the possibility that boron deficiency was a causal factor.

Corky spots, irregular in size and shape, occurred sporadically in the fleshy tissues of the root, and could not be detected without cutting it. Small surface cavities were sometimes associated with spots located near the periphery of the root, but none of the spots was observed to erupt to form a surface lesion. Microscopically observed, the corky spots were shown to be composed of a central area of collapsed cells surrounded by a suberized phellem layer several cells thick.

The first leaves of sprouts from severely corked seed roots to unfold were either stunted and deformed or showed an indistinct necrotic stippling near the margin of the leaf blade. These spots enlarged in 4 or 5 days to a diameter of $\frac{1}{2}$ to 1 mm. and then dropped out, leaving the leaf margin perforated, and the margins appeared scalloped owing to the uneven expansion of the leaf blade as the spots enlarged. A recovery followed, as the succeeding leaves unfolded without showing any visible symptoms and the affected leaves were shed. At pulling time the sprouts appeared to be healthy.

On infected sprouts transplanted to the field, as soon as the vine growth began to decline after from 4 to 6 weeks' normal growth, the older leaves showed an indistinct pale yellow or green mottling. Later a purple discoloration appeared at the margins of these spots and in a few days clearly defined purple ring spots were formed. When these fade, the leaves became chlorotic, eventually showed a dull bronze mottling, and soon fell. As the leaves mottled, internal cork was invariably found in the roots.

It was observed that on varieties devoid of anthocyanin pigmentation, no purple ring spot or bronzing appeared, but the spots remained yellow and chlorosis of the leaves set in, the plants assuming a prematurely aged look. The symptoms seem similar to those of a virus disease of sweet potato described by Hansford [*R.A.M.*, xxiv, p. 117] from East Africa, notably as regards bronzing of the leaves, although root symptoms are not mentioned by him. Internal cork is general, though at a low level, in South Carolina, to which state it is probably confined.

Roach (W. A.). **Mineral deficiencies in agricultural and horticultural crops.**—*Rep. E. Malling Res. Sta., 1944*, pp. 43–60, 2 figs., 1945.

In this report of work done by the joint team of the East Malling Research Station and the Research Institute of Plant Physiology, Imperial College of Science and Technology, it is stated that leaf-analysis and -injection methods have been used on agricultural and horticultural crops during the war for the diagnosis of mineral deficiencies. The results showed that widespread partial and complete failures in potatoes on freshly ploughed derelict land were associated with calcium deficiency and in most localities visited with magnesium deficiency also, though neither could be diagnosed by leaf symptoms. Rectification of the deficiency increased the crop in 1943 by 3,000 tons on these derelict lands alone. By means of these methods manganese deficiency was diagnosed in wheat that showed no symptoms, spraying with manganese sulphate increasing the yield to an economically important amount. The yield of early potatoes, showing no symptoms, but in which manganese deficiency was diagnosed by leaf injection, was increased by spraying with manganese sulphate by from four to five tons per acre. Widespread and severe deficiencies of potassium and of iron or manganese or both were diagnosed in apples. In cherries multiple deficiency of manganese, iron, and zinc was cured by injection of all three elements.

Meier (K.). **Bericht der Eidg. Versuchsanstalt für Obst-, Wein- und Gartenbau in Wädenswil für das Jahr 1943.** [Report of the Federal Experiment Station for Fruit-Growing, Viticulture, and Horticulture at Wädenswil for the year 1943.]—*Annu. agric. Suisse*, lviii, 10, pp. 891–953, 1944.

Much of the work described in this report [cf. *R.A.M.*, xxiii, p. 90] has already been noticed from other sources, but the following items may be of interest. Only one of several chemical preparations tested for their efficiency against apple scab [*Venturia inaequalis*] was found by C. Hadorn to be equal to pomarsol, and that was 2317 W (I.G. Farben) [ibid., xxii, p. 315], which may safely be applied to sulphur-sensitive varieties. S.B. 42 (Chemische Fabrik, vorm. B. Siegfried, Zofingen) gave good control of scab, but was incompatible with lead arsenate.

In further experiments by the same worker to determine the relative merits of various 'reserve sprays' [loc. cit.], 4 per cent. Bordeaux mixture again proved its worth, while 2 per cent. copper Sandoz also gave good results; however, as it does not form as close or even a deposit as Bordeaux mixture, it should be applied as late as possible in the season. Pomarsol 4160 exerted a certain prophylactic action, but was not sufficiently persistent. It is essential that a fungicide should be found combining a protective effect of reasonable duration with safety to the trees.

C. Hadorn further tested a number of German copper-saving plant-protectives against vegetable diseases.

H. Lüthi found *Penicillium* the most refractory of the moulds contaminating sweet must, *Aspergillus* and *Mucor* spp. being less prevalent in industrial plants. Ethyl alcohol, the usual disinfectant, failed to destroy the spores of *P.* spp. in some of the writer's tests even after several hours' exposure.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, lvi, 11, pp. 503–506, 5 figs., 1945.

In New South Wales banana leaf spot (*Cercospora musae*) [*Mycosphaerella musicola*: *R.A.M.*, xxi, p. 123; xxiv, p. 354] and 'speckle' (areas of black or greyish dots on the under side of older leaves, of indefinite etiology but believed to be a secondary development of injury by red spider) [cf. ibid., xxiv, p. 428] generally occur together. The most destructive form of leaf spot develops during rainy weather in summer, many leaves being attacked at the heart-leaf stage or as they are unfurling. Most infection takes place through the under surface. The heaviest losses are sustained by plants carrying bunches of fruit during the period January to May; most of the foliage supporting these bunches emerges in summer and if not sprayed it is generally severely attacked. Speckle may be restricted to patches, or it may involve large areas of leaf. The affected parts exude droplets of moisture in rainy weather, and large portions of the leaf ultimately succumb.

Defoliation caused by these two conditions results in heavy loss of fruit. Sometimes the bunches drop off, and the survivors are poorly filled, the pulp being discoloured and over-mature. After ripening, the fruit is dry and has a poor flavour.

Three or four waves of leaf-spot activity occur during the year, each following upon a period of rain. The spring and summer outbreaks are much less serious than the later ones. Speckle is also most destructive in autumn and winter.

Control measures recommended against both conditions consist in spraying each month from early December until March all plants bunching from January to May with a suspension of copper oxychloride ($1\frac{1}{2}$ lb. per 40 gals.), and colloidal sulphur (1 lb. per 40 gals.), plus a wetting agent (1 fl. oz. per 16 gals.). In February and March spraying should be applied to plants bunching from June to August. Every spray must be directed to the under side of the three youngest leaves and to the heart leaf, and spraying should be discontinued when the bunch is out. The spray should be applied from two directions at the heart leaf, to reach the central cavity. Bordeaux mixture (1–1–10) may be used if preferred. Vigorous growth should be

promoted by de-suckering to one plant—one sucker, or two plants—two suckers, fertilizing, weed control, and winter cultivation. In valuable plantations the installation of permanent spray lines may be advisable.

Against passion fruit brown spot (*Alternaria passiflorae*) [ibid., xxi, p. 364] the most useful spray is Bordeaux mixture (4–4–40), which should be applied in spring, before the vines become too dense, and repeated at monthly intervals throughout summer and autumn. The spray should be applied at 200 lb. pressure, and good coverage secured of canes and foliage. The removal of diseased leaves by hand in conjunction with spraying is worth trying in small plantations.

MILLER (R. W. R.). **Annual Report, Department of Agriculture, Tanganyika Territory, 1944.**—9 pp., 1945.

Potato blight (*Phytophthora infestans*) [*R.A.M.*, xxiv, p. 8], having lately been reported from Kasulu in the Western Province and from Mbeya in the Southern Highlands Province of Tanganyika Territory, is now present in all the important potato-growing areas in the Territory; and the bacterial ring rot of potatoes recently recorded in Kenya [ibid., xxiv, p. 200] has been found occurring in one field in the Usambara Mountains in a crop grown from imported seed. Blight (*P. infestans*) of tomato has appeared in the Territory and a virus disease of sweet potato, which is also present in the Belgian Congo and in Uganda [see above, p. 98], has been observed in the Lake Province, causing considerable loss of crop.

GILLMAN (H.). **Sisal Experiment Station, Tanganyika Territory. Report for the year 1944.**—16 pp., 2 graphs, 1 diag. [? 1945. Received January, 1946.]

During 1944 the only noteworthy disease that affected sisal [*Agave rigida* var. *sisalana*] at the Tanganyika Experiment Station was a physiological condition producing a yellow discoloration of the tip ends of the lower leaves, which then turned reddish, and finally died back. The trouble appeared to be associated with some unknown soil factor, but there was no evidence that it was related to the nitrogen, potassium, or phosphorus status of the soil [cf. *R.A.M.*, xxiv, p. 508].

Papaws died off in rather large numbers as a result of bud-end rot due to *Pythium* sp. [cf. ibid., xxiii, p. 235].

WILLIAMS (R. O.). **Annual Report on the Department of Agriculture, Zanzibar Protectorate, 1944.**—8 pp., 1945.

In continued investigations on the 'sudden death' of cloves [*R.A.M.*, xxiii, p. 40] during 1944, solutions of minor elements applied to clove seedlings produced no noteworthy symptoms, except in the case of boron, which caused colour changes in the leaves. Leaf samples from the treated plants were collected, dried, and despatched with others, to the Long Ashton Agricultural and Horticultural Research Station, for spectrographic analysis. Experimental watering of mature trees selected from a block threatened with decimation by 'sudden death', to observe the effect of maintaining a constantly moist soil, was without material effect on the rate of mortality.

The possibility of regenerating a block of trees under a gradual reduction of canopy was, however, successfully demonstrated on an affected site cultivated under a system of management recommended for ordinary plantation conditions. Young saplings interplanted between moribund old trees are now maturing well and casualties have been few.

Fifty-seventh Annual Report of the Colorado Agricultural Experimental Station for the fiscal year, 1943–44.—44 pp., 1944.

The following items may be noticed in this report [cf. *R.A.M.*, xxii, p. 381]. Mild strains of peach mosaic [ibid., xxiv, p. 154] continued to show antagonism to

severe strains, and it is suggested that the use of nursery stock inoculated with harmless mild strains may offer a means of mosaic control where eradication is not possible.

Dusting with copper oxide controlled tomato fruit rot [unspecified] as effectively as Bordeaux spray; and in home gardens staking and mulching are recommended as reducing or preventing the disease. Technical studies showed that the fungus chiefly attacks the blossom end of the fruit, which in some susceptible varieties is less resistant than the stem end. Resistance would appear to be associated with the presence of crystals in the fruit cells. Some varieties definitely showed resistance.

A preliminary study was made of root rots of sugar beet; and *Verticillium* wilt of sugar beet was found to be correlated with soil temperature. The addition of fertilizers to the beet seed, plus fungicides, gives better seedling stands than the use of fungicides alone, a fact regarded as of great importance in view of the sheared seed used to-day.

Fifty-third, fifty-fourth, and fifty-fifth Annual Reports of the New Mexico Agricultural Experiment Station for 1941–2, 1942–3, and 1943–4.—78 pp., 11 figs., 1 graph, 1942; 62 pp., 2 figs., 1943; 76 pp., 6 figs., 1944. [Received December, 1945.]

The following are among the items of phytopathological interest in these reports. *Fusarium* [*vasinfectum*] var. *zonatum* [f. 1] and *Phoma terrestris* predominated in the numerous isolations made from onions suffering from pink root rot [*R.A.M.*, xvii, p. 7; xxiv, p. 45] in various stages of development, the latter fungus apparently being the primary agent of the disease and the former a wound parasite. Chloropicrin gave effective control of the pathogens in greenhouse soils when applied at the rate of 3 c.c. per hole 6 in. deep and 12 in. apart, but larger quantities of the fumigant are required for field treatments, further experiments on which are planned. *P. terrestris* appears to be more susceptible to high temperatures than *F. vasinfectum* var. *zonatum* f. 1.

The results of several years' work have shown that resistance to curly top in sugar beets [ibid., xxiv, pp. 83, 130] is obtainable through breeding and selection; in tests in 1943–4, 67 beets from 11 varieties were selected in connexion with the development of combined resistance to curly top and leaf spot (*Cercospora*) [*beticola*].

In uniform nursery tests in 1943 on 60 lucerne varieties and strains New Mexico Common was equally resistant to wilt (*Phytomonas* [*Corynebacterium*] *insidiosum*) with any of those tested. The disease, which is probably the chief limiting factor in the growth of lucerne in New Mexico, as elsewhere, occurred in a severe form.

In 1942 the following five out of 11 tomato varieties in the order named were outstanding in resistance to western yellow blight [curly top: ibid., xxi, p. 103]: Pearson, Pan America, Nystate, Stokesdale, and Bonny Best.

Levine (M.). **Colchicine and X-rays in the treatment of plant and animal overgrowths.**—*Bot. Rev.*, xi, 3, pp. 145–180, 1945.

Colchicin is here treated historically, in relation, *inter alia*, to its effect on plants and animals, to its action in conjunction with X-rays and bacterial filtrates on tumours, and to its use in genetics. Colchicin, applied with lanoline paste to an onion plant infected with *Bacterium tumefaciens* [*R.A.M.*, xix, p. 461] did not arrest the development of the tumour, but, when applied to a well-formed gall, death of the overgrowth ensued. It is stated that crown gall on economic plants may be treated by preventive methods which will avoid the introduction of the causal organisms.

Khristov [or Christoff] (A.). Бактериалниять ракъ по овощнитѣ дървета въ И България. [Crown gall on fruit trees in Bulgaria.]—*Спис. Змед. Опит. Инсти България* [*J. agric. Exp. Stas Bulgaria*], x, 1, pp. 3–27, 2 figs., 1940. [English summary. Received December, 1945.]

Crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) of fruit trees is common, and the source of great damage, throughout Bulgaria. The bacterium has been isolated in that country from tumours on greengage, pear, apple, mahaleb [*Prunus mahaleb*], and apricot trees; and artificial inoculations on stems of tomato, sunflower, greengage, pear, and apple with isolations from greengage, pear, and apple, have given positive results. An examination of the rootstocks from 113 specimens of *P.* spp. and varieties from 1932 to 1939 showed that No. 96 (damson) and No. 108 (*P. spinosa*) were completely resistant. Unfortunately, the damson tree has since been destroyed. Of the *P. spinosa* trees, two bore no tumours, but had several small, conical excrescences round the incisions on the main roots, the significance of which as possible symptoms of crown gall requires further investigation.

A bibliography of 155 titles is appended.

Wormald (H.) & Garner (R. J.). **An experiment on the control of crown gall on vegetatively raised Apple rootstocks.**—*Rep. E. Malling Res. Sta., 1944*, pp. 73–74, 1945.

In a large-scale test carried out at East Malling in 1938 to test the value of uspulun as a protective against crown gall [*Bacterium tumefaciens*] of apple rootstocks raised by layering or stooling [cf. *R.A.M.*, xix, p. 544; xxii, p. 487], the root systems and stem bases of Malling II rootstocks (as removed from the layer rows) were immersed in a 'slurry' of uspulun and soil, and the rootstocks planted out towards the end of March. The treatments used were, A ($\frac{1}{2}$ per cent.), 4 oz. uspulun in $1\frac{1}{2}$ gals. water plus $3\frac{1}{2}$ gals. soil, B ($\frac{1}{4}$ per cent.), 2 oz. uspulun in the same, and C, no uspulun. Of 400 rootstocks subjected to each treatment and lifted in May, 1939, 189 (47·3 per cent.) were alive in treatment A, 173 (43·3 per cent.) in B, and 91 (22·8 per cent.) in C. The numbers of living rootstocks free from galls in the three treatments were, respectively, 99, 84, and 16; the percentages of living rootstocks without galls were 52·4, 48·6, and 17·6, respectively; and the percentages of clean rootstocks out of total treated were, respectively, 24·8, 21, and 4. Even better results would probably have been obtained if the uspulun had been used at a higher concentration.

Grieve (B. J.). **II. Studies in the physiology of host-parasite relations. III. Factors affecting resistance to bacterial wilt of Solanaceae.**—*Proc. roy. Soc. Vict.*, N.S., lv, 1, pp. 13–40, 2 figs., 7 graphs, 1943. [Received December, 1945.]

Heavy and rapid infection of potato and tomato plants by *Bacterium* [*Xanthomonas*] *solanacearum* [*R.A.M.*, xxiii, p. 9] is induced by high soil moisture and in dry soil the plants are less susceptible to attack, the positive relationship between soil moisture and disease incidence being indicated by the severity of the disease encountered in the moist soil of the Koo-wee-rup district of Victoria. Optimum conditions favouring a rapid spread of the pathogen in the host comprise durable temperatures falling between 66° and 73° F. with mean light intensity of 800 ft.c. in the glasshouse during the summer months. Plants grown under high humidity showed greater susceptibility than those grown under normal glasshouse conditions. Rate of transpiration did not affect the passage of the pathogen up the vessels. The optimum rate of movement of the organism in the vascular bundles in wet soil at 73° was 5 mm. per hour for potato and 2·2 for tomato. The minimum, optimum, and maximum temperatures for the growth of *X. solanacearum* were 15°,

32°, and 35° C., respectively. Significant differences in height, leaf area, and water content of tomato plants grown in wet as against dry soil were disclosed by physiological and anatomical studies, while the vessels were larger and more numerous. It is believed that increased water content is the factor which materially increases the susceptibility of the plant to invasion.

Franco do Amaral (J.). **Doenças vasculares das plantas causadas por bactérias.** [Vascular diseases of plants caused by bacteria.]—*Biológico*, xi, 9, pp. 250–253, 1 fig., 1945.

A study was made at the Biological Institute, São Paulo, Brazil, of the modes of infection of representatives of two groups of phytopathogenic bacteria, viz., non-specific (*Phytomonas* [*Xanthomonas*] *solanacearum*) and specific (*P.* sp. on cassava) [*R.A.M.*, xxii, p. 465]. The action of the former on potato, tomato, and tobacco consists in a purely mechanical obstruction of the vessels [see preceding abstract], whereas the latter secretes extracellular enzymes which exert a strong amylolytic effect on the starch contents of infected cassava plants. An ammonium sulphate precipitate of a culture filtrate of the cassava pathogen was experimentally shown to retain its amylolytic activity for over a year.

The agents of vascular diseases are disseminated in nature by various means, chiefly agricultural implements. In the case of *X. solanacearum* control may be effected by a tri- to quadrennial rotation, including, for instance, sorghum and soy-bean, which are immune from the wilt, while any other crop will serve to hinder the spread of the cassava disease, resistance to which has been shown at the Campinas Agronomic Institute by the following varieties in the order named: Branca [White] de Santa Catarina, Areal, Brava Preta [Black] de Suriú, and Itú.

Ekstrand (H.). **Höstsädens och vallarnas övervintring vintern 1944–45.** [Autumn cereal and pasture grass overwintering during the winter of 1944–45.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1945*, 4, pp. 49–53, 1945.

Snow mould of cereals (*Fusarium* [*nivale* = *Calonectria graminicola*]) was unimportant during the winter of 1944–5 in south and central Sweden [cf. *R.A.M.*, xxii, p. 99], but caused heavy damage in the more northerly districts, often destroying whole fields of rye. The distribution of *Typhula itoana* and *T. borealis* fell within much the same limits. Indications of differences in varietal reaction to these organisms were observed in experiments with wheat and rye, and in one of the tests on the former crop early sowings (21st August) were more severely damaged than late ones (19th September). *T. borealis* also occurred in a destructive form on timothy [*Phleum pratense*] in the far north, the yield of a second-year seed crop at a State experimental farm, for instance, being reduced by 25 to 30 per cent. Clover rot (*Sclerotinia trifoliorum*) was little in evidence, a surprising fact in view of the favourable climatic conditions for the pathogen—a long, mild autumn, with heavy precipitation, and an open winter.

Buchholtz (W. F.). **The 1941 epiphytotics of Puccinia rubigo-vera and Puccinia coronata in South Dakota.**—*Proc. S. Dak. Acad. Sci.*, xxii, pp. 64–66, 1942. [Received January, 1946.]

In 1941 occurred probably the most severe epidemics of wheat brown rust (*Puccinia rubigo-vera*) [*P. triticina*] and crown rust of oats (*P. coronata*) ever observed in eastern South Dakota. The incidence of infection by *P. triticina* on the susceptible Thatcher and the resistant Pilot and Rival varieties was 85, 3, and 2 per cent., respectively, and the yields 15·9, 20·9, and 21 bush. per acre, respectively, the corresponding figures for 1940 being 35, 1, and 1 per cent., respectively, and 35·4, 35·3, and 35·2, respectively. The two susceptible Richland and Miomark and one resistant (Tama) oats varieties showed 80, 80, and 0 per cent. crown rust, respectively, in 1941 and yielded 19, 21·5, and 55·9 bush. per acre, respectively, as

compared with a trace for the two susceptible varieties and 0 for the resistant and 83·4, 89·9, and 90·7 bush. per acre, respectively, in 1940. Official estimates of average loss from oats crown rust in 1941 were 50 per cent. (30 per cent. yield and 20 per cent. quality), the corresponding figure for wheat being 30 per cent. (20 and 10, respectively). Expressed as bushels of feed, these estimates indicate a loss of 23,000,000 bush. oats and nearly 9,000,000 bush. wheat, without reckoning the depreciation in quality.

Weather conditions in 1941 were ideal for rust development, rain falling regularly from 19th May until 13th July and usually being preceded by south winds and followed by one to three days of warm, humid weather. *P. triticina* was collected on 29th May (the earliest record for the State), and *P. coronata* appeared shortly thereafter. Dr. C. O. Johnston identified the races of *P. triticina* from the Nebred, Thatcher, Ceres, Hope, and Triumph varieties as 6, 9, 15, 28, 44, and 105.

Millikan (C. R.). **Studies on soil conditions in relation to root-rot of cereals.**—*Proc. roy. Soc. Vict.*, N.S., liv, 2, pp. 145–195, 12 pl., 3 diags., 1942.

Following increased growth and yield of wheat and oats and reduced severity of root rot as a result of small zinc sulphate dressings applied to Wimmera black fallow soil [*R.A.M.*, xviii, p. 97], investigations were directed to determining the effects of other soil minerals on the growth of cereals in that soil.

Experiments with three root-rot fungi occurring in Wimmera black soil, *Fusarium culmorum*, *Helminthosporium sativum*, and *Curvularia ramosa*, showed that manganese, copper, zinc, and iron were essential for their growth. Amino-nitrogen improved the yields of *F. culmorum* and *C. ramosa*, but caused sectoring in *H. sativum*. The addition of vitamins B, C, and nicotinic acid to the nutrient solution stimulated the growth of *H. sativum*.

Steam sterilization of Wimmera black fallow soil, while improving the growth of wheat considerably, rendered calcium, potassium, phosphorus, manganese, zinc, copper, and nitrogen more available to the plant, thus reducing their response to zinc sulphate applications. A similar result was obtained on Wimmera red fallow soil. Another experiment showed that formalin induced growth similar to or better than steam sterilization.

It was further demonstrated that plants grown on Wimmera red soil contained higher phosphoric acid, zinc, and copper, and lower lime, potash, iron, and manganese percentages than those grown on Wimmera black soil.

Zinc response on Wimmera black soil was destroyed by sterilization but was re-established by inoculating the sterilized soil two months before sowing with bacteria normally inhabiting it. The nutritional level of the plants grown on sterilized black soil reinoculated with fungi and bacteria usually present in unsterilized soil was found eight weeks after germination to be much higher than that of plants grown in unsterilized soil, notwithstanding a decrease in the percentages of phosphoric acid, potash, magnesia, zinc, and manganese.

On Wimmera black wheat stubble soil the increase in plant growth resulting from soil sterilization was relatively far greater than on comparable fallow soil. Similarly the response to applications of mineral mixtures was greater on black stubble than on fallow soils under both field and greenhouse conditions, and up to the heading stage sometimes gave equal or better results in stimulating growth on stubble soils under greenhouse conditions than soil sterilization. This is thought to show that the poor growth of oats or wheat normally obtained on Wimmera black stubble soils is attributable more to the inability of the plants to secure a sufficient supply of nutrients from the stubble soil than to root-rot infection.

The addition of magnesium, copper, cobalt, molybdenum, nickel, and boron to stubble soil mixtures appreciably increased the weight of the matter produced, but depressed the yield when applied to black fallow soil, which suggests that soil

organisms may reduce the amount of nutrients available to the plants by drawing on them for their own vital processes, a competition certain to be serious where the supply of nutrients approaches the threshold value for healthy plant development in that particular soil [ibid., xx, pp. 352, 450].

It is emphasized that the incidence of rainfall in relation to heading under field conditions was found to be fundamental in determining the relative differences in yield induced by mineral treatment, which accounts for the greater relative improvement in growth recorded under greenhouse conditions.

In the field increased growth derived from mineral applications to wheat and oats on Wimmera black soil was accompanied by a significant decrease in root rot, but the relatively less favourable growth increase after mineral applications to Wimmera red soil indicates the importance of determining the particular admixture of nutrients required by a given soil. Root rot in the Wimmera district is regarded as due to a complex of organisms and, unless the soil conditions are comparable, the results of greenhouse pathogenicity tests with selected fungi would have little or no relation to the effect in the field. Furthermore, physiological disorders need to be distinguished from the direct effects of foot- and root-rot fungi and the alleviation of the former decreases the apparent severity of the latter.

SMIT (J.) & MULDER (E. G.). **Magnesium deficiency as the cause of injury in cereals.** —*Meded. LandbHoogesch. Wageningen*, xlvi, 3, 43 pp., 12 figs., 2 graphs, 1942. [Received October, 1945.]

In general, the addition of small amounts of magnesium sulphate to the soil sufficed to prevent or cure the Hooghalen or soil acidity [magnesium deficiency] disease of cereals in the authors' experiments in Holland [*R.A.M.*, xviii, p. 240], but in a few instances a supplementary treatment with calcium carbonate was necessary, the latter, however, being insufficient by itself. Using a microbiological method involving the culture of *Aspergillus niger* in a magnesium-free solution, it was ascertained that the fields producing diseased crops almost invariably contained less than 50 γ magnesium for 3 gm. soil, compared with upwards of 100 γ in the same quantity of healthy soil. Both in healthy and diseased soils, however, the available portion of magnesium is a mere fraction of the total quantity present. For example, a highly acid 'field' soil (P_H 4), in which no trace of available magnesium could be detected, was shown to contain 20·4 mg. of the mineral per 100 gm., while the analysis of the same soil left in its normal healthy condition at P_H 5·4 revealed available and total magnesium contents of 200 γ per 5 gm. and 21·9 mg. per 100 gm., respectively.

The data obtained by microbiological and chemical determinations were reflected in the magnesium contents of healthy and diseased plants, the naturally larger quantities in the former being still further increased by soil amendments with magnesium sulphate. Supplementary treatments with calcium carbonate presumably act indirectly by improving the development of the root system and so enhancing its capacity for magnesium assimilation, since neutralization did not materially increase the amount of the element available to *A. niger*.

STEENBJERG (F.). **Kobber i Jord og Kulturplanter. Med særligt Henblik paa Gulspidssyge.** [Copper in soil and cultivated plants. With special reference to yellow tip disease.]—*Tidsskr. Planteavl*, xlv, 2, pp. 259–368, 5 figs., 5 graphs, 1940. [English summary. Received January, 1946.]

Much of the information presented in this exhaustive, fully tabulated survey of the relationship between the copper contents of soils and plants and disorders due to copper deficiency, known as 'reclamation disease', 'yellow tip', and so forth, has already been noticed in this *Review* from other sources, but the following summary of the salient points may be of interest. The disease is definitely attributable

to a deficiency of available copper in the soil [*R.A.M.*, xxii, p. 90], which sinks to a minimum at P_H 5·5 to 6·5; within this range, consequently, the heaviest yield increases are obtained by the addition of copper sulphate. In two years' pot tests on Kenya barley in sandy soil with a high humus content amendments of lime (as calcium carbonate) and more particularly of sulphur, adjusting the P_H to 7·6 and 5·4, respectively, resulted in substantial increases in yield over the untreated series, the outcome of field experiments being on an average comparable.

Grass was shown to be the crop with the maximum capacity to increase the available copper content of the soil on which it is grown. In planning rotations care must be taken to avoid a succession of crops depleting the soil of its copper content through their exorbitant demands on the mineral, root crops, for instance, withdrawing a much larger proportion of the available supply than grains.

Several weeks' or months' drying of soil samples in the laboratory tended to reduce considerably the amount of available copper, which was generally increased, on the other hand, by autoclaving; the loss sustained through desiccation was apparently irreversible, at any rate by subsequent moistening for periods up to ten days. The direct beneficial effects, especially on acid peat bogs, of an admixture of mineral soil from disease-free areas, are probably attributable to an increase in the total and available copper contents, while indirectly the amendment acts by augmenting the water-holding capacity of the soil.

Coke ash was shown by Hudig *et al.* [ibid., vi, p. 51] to contain relatively large amounts of available and total copper [cf. ibid., xxi, p. 134], which is also present in fair quantities in compost, whereas the copper contents of stable and liquid manure are insufficient to justify the use of these fertilizers for copper-deficiency control, except possibly in special cases.

A full account is given of the analytical methods devised by the writer and others for the determination of the copper contents of soils and plants. The order of magnitude of acid-soluble copper per ha. is computed at 0 to 150 gm. in deficient soils, compared with 1,000 to 2,000 gm. or more in those of normal composition, while 'transitional' soils contain 200 to 400 gm. A primary indirect cause of copper deficiency is undoubtedly a high humus content, this substance combining freely with cupric ions and thereby immobilizing the copper so that it cannot be utilized by the plants. Very promising results were obtained in experiments from 1937 to 1939 (still in progress at the time of writing), involving the admixture with the soil of finely ground metallic copper in various forms.

TYLER (L. J.). **Dwarf bunt of winter Wheat in New York.**—*Plant Dis. Reptr*, xxix, pp. 668–669, 1945. [Mimeographed.]

An investigation of a complaint by seedsmen at Perry, New York, that wheat bunt was unusually prevalent in some fields, revealed the presence of dwarf bunt (a race of *Tilletia caries*) [*R.A.M.*, xxi, p. 133; xxiii, p. 10] generally distributed in winter wheat fields in at least four counties of the State, the incidence affecting from a trace to about 20 per cent. of the heads. A spotty infection was noted in most of the fields examined and the Cornell 595 variety appeared to suffer most, particularly in stands grown from seed suitably treated with new improved ceresan, which, however, effectively controlled bunt caused by the smooth-spored *T. foetida*. The area of this outbreak surrounds the town of LeRoy in Genesee County where the organism was collected by Bayles in 1940.

VANDERWALLE (R.). **Une méthode rapide d'inoculation florale du Froment et de l'Orge par Ustilago nuda (Jens.) et Ustilago nuda tritici (Schaf.).** [A rapid method for the floral inoculation of Wheat and Barley by *Ustilago nuda* (Jens.) and *U. nuda tritici* (Schaf.).]—*Parasitica*, i, 2, pp. 58–63, 1 pl. (facing p. 57), 1945.

An apparatus devised by the author for the large-scale floral inoculation of cereals,

and based on the techniques of Moore and of Oort [cf. *R.A.M.*, xviii, p. 792], is described and figured. The container is evacuated by means of a rotary vacuum pump worked by a $\frac{1}{4}$ h.p. motor and the spore suspension introduced into the container by a tube through the base. With this apparatus it was possible to inoculate 180 ears of barley per hour. During 1941, 1,200 lines of winter and spring barley were inoculated with *Ustilago nuda*, many which in ordinary culture show only slight outward symptoms of loose smut giving up to 98 per cent. infection.

VOLOSKY DE HERNANDEZ (DORA). **Desinfestantes del 'carbón de la Cebada'.** [Disinfectants of Barley smut.]—*Agric. tec., Chile* (formerly *Bol. Sanid. veg., Santiago*), v, i, pp. 37–47, 1 graph, 1945. [English summary.]

A tabulated survey is given of experiments carried out for four years at one Chilean plant breeding station and for two at another in the control of barley covered smut (*Ustilago hordei*) on the Isaria variety with abavit (200 gm. per 100 kg. seed-grain), copper carbonate (300 gm.), formalin (300 c.c. per 100 l. water), hydrit (Dasco y Cía, Santiago), 100 and 200 gm., mercysol (Mussla, Santiago), 200 gm., and tillantin (Bayer), 250 gm. The best results were obtained with abavit and hydrit, both of which gave virtually perfect control, while mercysol was also effective in every year except one; tillantin was only moderately satisfactory, formalin very erratic, and copper carbonate of little value for the end in view. Notwithstanding the variations in the fungicidal efficacy of the several treatments, the yields from the different plots did not present any remarkable disparities.

ARNY (D. C.). **Inheritance of resistance to Barley stripe.**—*Phytopathology*, xxxv, 10, pp. 781–804, 6 graphs, 1945.

Two types of resistance and two of susceptibility to stripe disease (*Helminthosporium gramineum*) were apparent in the barley varieties under observation at the Wisconsin Agricultural Experiment Station [*R.A.M.*, xxiv, p. 497]. Persicum and Brachytic maintained a high level of resistance to the culture used in inoculation tests, some factors for resistance being evidently held in common by these two varieties. In crosses with Oderbrucker resistance appeared to be dominant and three factors were probably involved. The resistance of Lion was incomplete and seemed to be inherited in a different manner from that of Persicum, dominance being indefinite and presumably dependent on a number of factors. The susceptibility of Oderbrucker was probably of a different order from that of Colsess and Iris, since in the crosses Persicum × Iris and Colsess × Brachytic a difference of one major and one modifying factor pair was involved in each case. Marker genes in six of the seven linkage groups present in barley were tested for their relationship to stripe reaction with negative results.

BUCHWALD (N. F.). **Über Puccinia hordei Otth (Syn. P. simplex (Kcke.) Erikss. & Henn.) und P. hordei-murini n.n. (Syn. P. hordei Fckl.).** [On *Puccinia hordei* Otth (syn. *P. simplex* (Kcke) Erikss. & Henn.) and *P. hordei-murini* n.n. (syn. *P. hordei Fckl*).]—*Ann. mycol., Berl.*, xli, 4–6, pp. 306–316, 1943. [Received November, 1945.]

A critical examination of the mycological and phytopathological literature on barley dwarf rust [*R.A.M.*, xv, p. 209] has convinced the author that the widely used designation of *Puccinia straminis* var. *simplex* Körnicke, 1865, is incorrect, the variety in question having been first differentiated by Winter in 1882. The valid name is therefore *P. hordei* Otth, 1871, *P. hordei* Fckl, 1873, being a homonym, and it is consequently proposed to change the designation of the latter to *P. hordei-murini* n.n.

P. hordei Otth (syn. *P. anomala* E. Rostr.) and *P. hordei-murini* are distinguishable on a purely morphological basis, the number of germ-pores in the uredospores of the former averaging 8 to 9, compared with 10 to 12 in the latter, while the proportion of mesospores in *P. hordei* averages 80 and never sinks below 50 per cent., whereas in *P. hordei-murini* the percentage usually lies round about 28 and scarcely ever exceeds 40. On the other hand, the differences between the teleutospore dimensions in the two species are inconsiderable, though those of *P. hordei-murini* are generally rather smaller (mean 46·65 μ as against 53·24 μ in *P. hordei*).

Both the uni- and bicellular teleutospores of *P. hordei* show a common peculiarity of *P.* spp., namely, the longer (56 μ) and narrower (22·7 μ) measurements of those originating on the leaf sheaths in relation to those from the blades (46·9 and 23·5 μ, respectively).

STOLL (A.). **Les alcaloïdes de l'ergot.** [The ergot alkaloids.]—*Experientia*, i, 8, pp. 250–262, 17 figs., 1945. [English summary.]

Contemporary studies on the clinical applications and chemical properties of rye ergot [*Claviceps purpurea*] are reviewed and critically discussed, and a brief account is given of the large-scale operations now in progress in Switzerland for the procurement of the drug by mechanical inoculation of the growing crop [*R.A.M.*, xxv, p. 65].

WELCH (A.). **Pythium root necrosis of Oats.**—*Iowa St. Coll. J. Sci.*, xix, 4, pp. 361–399, 9 figs., 1 graph, 1945.

Every year throughout Iowa oats in the seedling and boot stage develop a condition in which the plants are yellow and stunted, while the lower leaves may be brown and dead. At heading time the affected plants appear to recover, but the crop is reduced. The symptoms become most marked when the conditions fail to favour rapid growth.

A detailed study of the disease from 1938 to 1942, inclusive, showed that serious root necrosis was caused to oats each year by *Pythium debaryanum*, this fungus being the predominating organism in infected roots of field-grown oats in the early part of the season. During the first week in May 80 to 90 per cent. of the isolations from field-grown oat seedlings yielded *Pythium*. Successive isolations in late May and early June gave lower percentages of *Pythium* and higher ones of secondary fungi. In no instance during 1938, 1939, or 1940 was *Pythium* isolated later than 25th June.

In greenhouse tests *P. debaryanum* caused serious seed rot and root necrosis at 25° C. and below, infection being particularly serious between 8° and 15°. In 1938 and 1939 the average temperature of the top inch of soil during May was, locally, about 13·5°. Greenhouse tests in artificially infected soil also demonstrated that temperature, size, and age of seed planted, and the application of different amounts of inoculum played important parts in determining the severity of attack.

Of 232 oat varieties tested in artificially infected soil, Coast Black, Black Algerian, Early Red Rustproof, Red Algerian, Ruakura, and Flughafer were the most resistant, though resistance was in no case outstanding. Commercial varieties and wild species with 21 pairs of chromosomes showed more resistance than those with 14 and 7 pairs.

Oats grown in infected soil showed a reduced growth rate and delayed tillering. The oven-dry weight of plants grown in infected soil was about half that of plants in clean soil. Swedish Select oats grown to maturity in infected soil gave about half the yield of plants in clean soil.

The prevalence of *Pythium* on the roots of yellow and green plants in the field was found to depend on the date when the observations were made. If the isolations were made when yellowing was first observed, the yellow plants tended to

give the highest percentage of *Pythium* isolates. The roots of the yellow plants rotted more rapidly than those of green plants, secondary organisms entered speedily, and *Pythium* was isolated at a later date from green than from yellow plants. Nutritional deficiencies increased the injury caused by *Pythium* root necrosis.

Heavy dressings of nitrogen (as sodium nitrate, 200 lb. per acre) and complete fertilizer (6–8–12, 350 lb. per acre) prevented field-grown plants from becoming stunted and chlorotic, the applications making it possible for the plants to produce new roots and so replace the infected ones. Root replacement took place rapidly, and the plants grew vigorously, and appeared to be normal. There was no evidence that the treatment increased resistance. The evidence obtained showed that any factor that retarded plant growth favoured *Pythium* injury but did not affect pathogenicity. Under optimum conditions of growth oats continued to develop apparently normally, in the presence or absence of *P. debaryanum*, but if any factor intervened to limit optimum development, the fungus appeared to become more destructive.

WILKINSON (R. E.) & KENT (G. C.). **Some factors determining the infection of Corn by Ustilago zeae (Beckm.) Unger.**—*Iowa St. Coll. J. Sci.*, xix, 4, pp. 401–413, 3 figs., 1945.

In the experimental production of maize smut (*Ustilago zeae*) [*U. maydis*] in the greenhouse Davis's spiral whorl method of inoculation [*R.A.M.*, xiv, p. 750] was improved by using triethanolamine oleate as a detergent. With sporidia suspended in carrot decoction this gave the best results, while it was also less toxic to the host tissues, more constant in its composition, and gave higher and more severe infection than any other material tested. The sporidial suspension diluted to 1 in 100 with carrot decoction, plus triethanolamine oleate, produced a high degree of very severe infection.

The range of pathogenicity presented by matched pairs of sporidia, when tested on a single inbred line of maize, extended from the production of a few small galls to many large ones or to necrotic areas.

Of 125 monosporidial isolates tested, two were solopathogenic [ibid., xi, p. 363]. Chlamydospores produced by these two were germinated, and single sporidia isolated. Of the 11 monosporidial isolates from chlamydospores of one, three were of one sex, three of the other, and five solopathogenic; of seven monosporidial isolates from chlamydospores of the other, six were of one sex, one of the other, and none was solopathogenic. All seven solopathogenic cultures produced a small pinhead type of leaf gall extremely different from that induced by the 125 normal heterothallic combinations, and normal, large galls at the nodes or the union of leaf blade and sheath. A composite inoculum of eight matched pairs of sporidia was less virulent than the most virulent of the matched pairs.

LIVINGSTON (J. E.). **Charcoal rot of Corn and Sorghum.**—*Res. Bull. Neb. agric. Exp. Sta.* 136, 32 pp., 5 figs., 7 graphs, 1945.

Studies carried out in Nebraska on charcoal rot (*Macrophomina phaseoli*) of sorghum and maize [*R.A.M.*, xvi, p. 310; xxiv, p. 96] showed that when these hosts were grown in inoculated soil in the greenhouse the fungus caused both root rot and stalk rot. A soil temperature of at least 35° C. favoured the growth of the organism and one of 42° was most conducive to sorghum seedling blight. The highest percentage of stalk rot in mature sorghum plants in the greenhouse occurred at a soil temperature of 38°. Of various carbohydrates fructose supported the best growth, with glucose, mannose, galactose, and sucrose almost as good. Raffinose and sodium citrate permitted very slow growth and starch slightly better. Peptone was the best nitrogen source, followed by asparagin; urea gave

poor growth. The fungus grew well over a P_H range of 5·0 to 8·0 with an optimum between 6·0 and 7·0, except for the sorghum isolate, which did not respond well to differences in hydrogen-ion concentration. Low soil moisture retarded the growth of the host and favoured both seedling blight and stalk rot.

In the field either moisture or temperature can limit the distribution and severity of the disease. The heaviest damage from stalk rot of sorghum and maize occurred in the south-central counties of Nebraska in 1940, when the total rainfall in July, August, and September was 4·8 in. and the average daily air temperature 24°. The average maximum daily temperatures in July and August (the hottest months) ranged from 30° to 36°, the daily temperatures often being over 38°. Even with these high temperatures, charcoal stalk rot was rare in irrigated fields. It was also hard to find in low areas in fields in eastern Nebraska, where the summer rainfall since charcoal rot was first observed has been at least 9·4 in. The disease has, however, frequently been noted in maize and sorghum on hilly land, particularly near the shoulder of a hill, where the drainage was best. In western Nebraska, where the average summer rainfall is 4·8 in. or less, charcoal rot has not been important. Here, the average air temperature was under 22·5°, which was the lowest average air temperature at which stalk rot developed in south central and south-eastern Nebraska. The data also indicated that high moisture (rainfall to 6 in. or above) prevents the development of the rot.

In greenhouse experiments, using Wisconsin soil temperature tanks and seed of Alliance sorghum, seedling blight was greatest in dry soil at 37° and gradually decreased in intensity to 25°, and in wet soil a similar infection curve was obtained except that at 25° there was much more disease than at 28°. Stalk rot of mature plants was greatest at 37°, decreasing at lower temperatures in both wet and dry soils. No stalk rot occurred at 28° or 25° in the wet or at 25° in the dry soil. In further similar experiments with steam-sterilized and chloropicrin-treated soil, the results indicated that the soil microflora considerably retarded the activity of the fungus. Virtually no seedling blight occurred in inoculated soil treated with chloropicrin, though a high percentage of seedlings were killed in inoculated, steam-sterilized soil. With mature plants a similar effect was observed, though it was less marked. In another series of experiments low soil moisture just preceding and during maturity was essential for the development of a high proportion of rotted stalks and sclerotial formation.

M. phaseoli enters the sorghum plant through the roots and passes into the stem, setting up stalk rot. Advance is primarily through the cortical tissues, where rot may become extensive before the stele is invaded. The root does not die until the inner tissues have been destroyed.

Buchholtz (W. F.). **A comparison of dosages of copper carbonate and ethyl mercuric phosphate with chloranil and sulphur as Sorghum seed treatments.**—*Proc. S. Dak. Acad. Sci.*, xxiii, pp. 56–64, 1943. [Received January, 1946.]

Copper carbonate (18 per cent.) at $\frac{1}{4}$, $\frac{1}{2}$, standard, and double standard dosages and ethyl mercuric phosphate (new improved ceresan) at the same four rates for 1 and 5 per cent. concentrations were compared with chloranil (spergon) and flowers of sulphur at 3 oz. per bush. as treatments against soil- and seed-borne seed-rotting fungi and covered smut [*Sphacelotheca sorghi*: *R.A.M.*, xxiii, pp. 102, 103] of Sooner Milo grain and 39–30–S forage sorghum.

Copper carbonate at all four dosages, spergon, and sulphur gave satisfactory smut control, but new improved ceresan was only partially effective below the standard rates. Copper carbonate, spergon, and new improved ceresan conferred adequate protection on the seed and resulted in good yields, but sulphur exerted a toxic effect which reduced the seedling stand below that of all other lots, treated or controls.

Southwick (R. W.). **Pressure injection of iron sulphate into Citrus trees.**—*Proc. Amer. Soc. hort. Sci.*, xlvi, pp. 27–31, 2 figs., 1945.

After stating that iron deficiency, chlorosis, or lime-induced chlorosis is somewhat prevalent in the citrus-growing areas of California, the author describes a liquid pressure injection apparatus designed to be of use in correcting the deficiency. It consists of three 4 gal. airtight iron containers with an opening in the top, a valve stem for applying air pressure, and an outlet pipe extending from the bottom through the top with T couplings and nipples so that four hoses and valves can be connected to the outlet pipe. Attached by a coupling to the end of the hose there is a brass nipple to be screwed into holes drilled in the trees. Air pressure is secured from a small portable air compressor. Liquid pressure injections were applied to some 60 15-year-old Valencia orange trees and about 200 30-year-old lemons. The injection material was dissolved in 1 gal. water and placed in the 4-gal. container, air pressure being applied through the valve stem to between 80 and 100 lb. per sq. in. Four $\frac{3}{8}$ in. holes 4 in. deep were then bored in the trunk at about 10° angle. After they were filled with liquid and the nipples had been screwed in, the hoses were connected, removing as much air as possible, and the pressure was turned on in each hose. It took from 15 minutes to 3 hours for 1 gal. of liquid to pass into a tree. Concentrations of from 30 to 200 gm. ferrous sulphate were used per tree, alone, or in combination with manganous sulphate, zinc sulphate, or copper sulphate.

The results showed that injections of 50 to 100 gm. ferrous sulphate per tree corrected the condition for periods of from two to four years, with an even distribution of iron throughout the tree. Severe injury was occasionally caused to small twigs, the reason for which has not yet been ascertained.

Bain (F. M.). **A progress report on the dying of Limes.**—*Proc. agric. Soc. Trin. Tob.*, xlv, 2, pp. 123–149, 1945.

This inquiry into a possible connexion between the nutritional status of limes and their death from root disease was undertaken in the light of Fennah's findings [*R.A.M.*, xxii, p. 355], and the results suggest that the disease is associated with a lack of balance between the growth period and the length of dormancy, tending to bring about a prolonged shortage of water within the plant. Shade, wind protection, and contour drainings, which favour satisfactory water relations, assist in retarding or preventing the onset of the disease, whilst the absence of such factors is associated with its presence. Leaf analyses revealed higher nitrogen and potash contents and a narrower nitrogen-potash ratio for healthy than for diseased areas. Trees in dying areas show a longer dormant period than those in healthy ones, leading to more luxuriant flowering and this, combined with the lower nutritional status, induces carbohydrate deficiency and starvation of the rootlets. The use of organic matter and fertilizers to redress carbohydrate deficiency in the plants in dying areas is tentatively recommended, pending the results of further laboratory and field study.

Webber (H. J.). **The 'tristeza' disease of sour Orange rootstock.**—*Citrus Ind.*, xxvi, 5, pp. 18–20; 6, pp. 18–19, 20–22, 1945. [Abs. in *Exp. Sta. Rec.*, xciii, 5, p. 595, 1945.]

After reviewing his own and other workers' investigations into 'tristeza' [root rot] of citrus [*R.A.M.*, xxiv, pp. 366, 410], the author expresses the view that the available evidence eliminates as possible causes of the condition incompatibility of the sour orange stock with sweet orange, mandarin, or grapefruit, and the particular variety of sour orange used as stock. It is very improbable that the development of some substance lethal to the sour orange root, or soil or climatic

conditions, or trace-element deficiencies are responsible. The evidence suggests a virus origin.

TOMKINS (R. G.) & ISHERWOOD (F. A.). **The absorption of diphenyl and o-phenylphenol by Oranges from treated wraps.**—*Analyst*, lxx, 834, pp. 330–333, 1945.

Methods are fully described for the estimation of diphenyl [*R.A.M.*, xxiii, p. 252] and ortho-phenylphenol absorbed by oranges from wraps treated with these substances against green mould [*Penicillium digitatum*] infection, and the data resulting from their application to three cases of Jaffa fruit are tabulated. The amounts of diphenyl and ortho-phenylphenol taken up by the fruits from wraps impregnated with 100 mg. of the chemicals were 4 to 20 and 20 to 30 mg., respectively, per 100 gm. peel (= approximately one orange) [see next abstract].

MACINTOSH (F. G.). **The toxicity of diphenyl and o-phenyl-phenol.**—*Analyst*, lxx, 834, pp. 334–335, 1945.

Tests on laboratory animals at the National Institute of Medical Research showed the order of toxicity of diphenyl and ortho-phenylphenol to be very low, and no fear need be entertained of any danger to the health of consumers from the minute quantities absorbed by oranges from wraps treated with these chemicals [see preceding abstract].

ARNDT (C. H.). **Viability and infection of light and heavy Cotton seeds.**—*Phytopathology*, xxxv, 10, pp. 747–753, 1945.,

Seeds of samples of the upland varieties of cotton (*Gossypium hirsutum*) from the harvests of different years in various States were acid-delinted and separated into light and heavy fractions on the basis of their specific gravity. They were then dried, the relative mean weights determined, and seeds of each lot germinated to ascertain their viability and the incidence of fungal and bacterial infection [*R.A.M.*, xviii, p. 105].

The light seeds, the proportions of which in the different samples ranged from 4 to 94 per cent., were rather more subject to internal fungal infection than the heavy ones, the differences in this respect being more considerable in the case of such organisms as *Rhizopus* spp., *Penicillium* spp., *Diplodia* [*Botryodiplodia*] *theobromae*, *Alternaria* spp., and *Aspergillus* spp. than in that of the important seedling parasites, *Colletotrichum* [*Glomerella*] *gossypii* and *Fusarium* spp. (including *F. moniliforme* [*Gibberella fujikuroi*]).

The viability of the light seeds was generally less than that of the heavy ones when the percentage of the former was small, but this disparity between the two groups was largely eliminated when the proportion of light seeds equalled or exceeded that of heavy ones. The author concludes that the general applicability of water-grading for improving seed quality is questionable.

COLEMAN (EDITH). **Autumn fungi at Emerald.**—*Vict. Nat.*, lxii, 1, pp. 4–7, 1 pl., 1 fig., 1945.

On 20th March, 1945, at Emerald, Victoria, the writer observed below black wattles (*Acacia mollissima*) badly infested by wattle goat moth [*Xyleutes d'urvillei* H.S.] larvae an abundance of *Cordyceps gunnii* fructifications, some barely showing above the deep litter of partly decayed vegetation. The length of the stem varied considerably. Where the larvae had been attacked at an early stage of development, and were still some distance from the surface, the stems ranged from 4 to 10 in. in length and the fruit bodies were small, whereas in the case of older larvae, on the point of pupation, the stem was less than ½ in. long and the fructifications

proportionately larger. The size of the burrow corresponded with that of the fruit body, which was completely formed below ground and raised to the surface by the lengthening stipe; it varied in shape from a single club to inch-wide specimens apparently composed of several flattened, confluent, dark olive-green, velvety clubs, ½ to 1¾ in. long. Cross sections from the apex of the club revealed copious filiform sporidia emerging through the perithecia, and under high power the eight-spored, glassy asci were clearly visible.

SCHENKER (P.). **Pilze und Insekten.** [Fungi and insects.]—Abs. in *Mitt. naturf. Ges. Bern.*, N.F., ii, pp. xxviii–xxx, 1945.

Examples of fungus-insect association commonly observed in Switzerland include the yeast beetle (*Cartodere filum*) and *Penicillium glaucum*, and the elm bark beetle (*Scolytus scolytus*) and *Graphium* [*Ceratostomella ulmi*: *R.A.M.*, xxiv, p. 211].

Of recent years some interesting cases of the actual parasitization of insects by fungi have come to the writer's notice. In the autumn of 1943, for instance, *Empusa tenthredini* Fres. developed in a virulent form on the black larva of the beet leaf wasp (*Athalia spinarum*), killing half to two-thirds of the population. An *E.* sp. differing in some respects from *E. aulicae* was detected on *Crambus* sp. on grasses in the Emmental.

Beauveria densa was found attacking cockchafers [*Melolontha melolontha*: ibid., xxi, p. 480] near Berne and Neuenegg in the autumn of 1943, while another species of *Beauveria* destroyed large numbers of *Sitona lineata* and other leaf-margin beetles in a red clover planting in the winter of 1943–4.

Isaria farinosa [ibid., xvi, p. 532] was active in 1942 and 1943 on the anther moth (*Charaeas graminis*), which occurred in epidemic form in the Emmental; the pre-pupal and pupal stages sustained particularly heavy damage. Larvae of the Geometrid *Acidalia herbariata* fed on dried white clover dusted with the conidia of *I. farinosa* died in a fairly short time, the few survivors failing to reach maturity. The fungus, which was also found on larvae of the moth *Tholera popularis* in the open, is readily cultured on beer wort agar, carrots, potatoes, or bread, the phototropic coremia, with orange-reddish bases, reaching 3 to 4 cm. in height; on full and skim milk in Erlenmeyer flasks shielded from the side light these organs grew in great luxuriance and attained a height of 8 cm.

In the summer of 1943, some larvae covered with the white mycelium of *I. farinosa* presented a setose appearance due to the protrusion of the black perithecial beaks, 1 to 2 mm. long, of *Melanospora parasitica* [ibid., xx, p. 560]. The latter fungus, a true parasite, was easily grown on cultures of *I. farinosa*, another *I.* sp., and *B. bassiana*, but not on those of *B. densa.*

PETKOV (P.). **Die Bekämpfung der Heuschrecken mit Empusa.** [The control of Locusts with *Empusa.*]—*Int. Congr. Ent., 1938*, 4, pp. 2616–2618, 1939. [Abs. in *Rev. appl. Ent.*, Ser. A, xxxiii, 4, p. 122, 1945.]

During outbreaks of *Calliptamus* (*Caloptenus*) *italicus* in Bulgaria, high mortality was produced among these locusts as a result of infection by *Empusa grylli* [*R.A.M.*, xxi, p. 45]. Experimental evidence demonstrated that the fungus spread rapidly in groups of the locusts, and that healthy individuals became infected when given food contaminated with the brown, pulpy matter found in the hind part of the abdomen of locusts killed by the organism. The development of the fungus was favoured by temperatures of 19° to 27° C. and moderate atmospheric humidity, while mass development in field conditions occurred only in summer. In field tests during August at 18·7° to 27·3°, with a relative humidity of 41 to 81 per cent., spores scattered on plants killed 83 per cent. of the locusts in six days.

Marchionatto (J. B.). **Nota sobre la 'muscardina verde' (Metarrhizium anisopliae [Metch.] Sor.).** [Note on the 'green muscardine' (*Metarrhizium anisopliae* [Metch.] Sorok.).]—*Rev. chil. Hist. nat.*, xlvi–xlvii, pp. 12–14, 1 fig., 1944.

Since 1937, when the 'green muscardine' fungus, *Metarrhizium anisopliae*, was determined on *Schistocerca paranensis* in Argentina, the writer has identified the same organism in different parts of the country as a parasite of *Cirphis unipuncta*, *Prodenius irex*, *Scapteriscus borellii*, and *Diloboderus abderus*. Infected chrysalids of the last-named present a particularly characteristic, spinulate aspect, due to the envelopment of the hairs covering the body by the white columnar coremia. Details of the morphology of the fungus are given.

Colhoun (J.). **The effect of boron on the development of Flax rust.**—*Gdnrs' Chron.*, Ser. 3, cxviii, 3071, p. 191, 1945.

Experiments in Northern Ireland have confirmed the results of those conducted in the United States by Hart *et al.* (*Phytopathology*, xxxiii, p. 1113, 1943) that the addition of boron to the soil does not satisfactorily control the development of flax rust (*Melampsora lini*) [*R.A.M.*, xxi, p. 291] either in the field or greenhouse. Moreover, the leaf tips are damaged, and the damage increases with the concentrations of solutions of borax, when it is applied in this form.

Millikan (C. R.). **Symptoms of copper deficiency in Flax.**—*Proc. roy. Soc. Vict.*, N.S., lvi, 1, pp. 113–117, 1 pl., 1944.

Liral Crown flax and Free Gallipoli wheat plants were grown in copper-deficient water cultures at the Research Laboratory, Burnley, Victoria, wheat being included as a test plant for the elimination of the copper.

The flax plants showed retardation after approximately four weeks, the leaf internodes produced later were short, the leaves thus having a somewhat rosetted appearance, and being much smaller than the controls. They became puckered and very twisted, the stems showing some twisting also. Later the leaves about the middle portion of the stem developed a dark, greyish-green, semi-transparent discoloration at the tips, soon drooped, and died from the tips downwards. The lowest leaves remained apparently normal, but secondary shoots sent out from the bottom soon became chlorotic with small, twisted veins. Finally growth ceased and the plants began to die from the tops.

Van Slogteren (E.) & De Bruyn Ouboter (Maria P.). **Onderzoekingen over virus-ziekten in bloembolgewassen. II. Tulpen. I.** [Studies on virus diseases in flower bulb crops. II. Tulips. I.]—*Meded. LandbHoogesch. Wageningen*, xlv, 4, 54 pp., 62 figs. (39 col.), 1941. [German and English summaries. Received October, 1945.]

Reviewing the historical records of tulip breaking [*R.A.M.*, xiii, p. 446], the authors point out that as long ago as 1637 Dutch bulb-growers knew how to induce this pathological variegation by grafting an infected on to a healthy plant. In Holland the chief agent in the spread of the disease was experimentally shown to be the aphid *Myzus persicae*, *Macrosiphum euphorbiae* [*M. solanifolii*] and *Doralis* [*Aphis*] *fabae* being also implicated to a lesser extent.

An important advance in the study of breaking has been made, consisting in the acceleration of current-season symptoms by very early inoculation, either by means of infected juice or with the aid of aphids, preferably when the length of the shoot does not exceed 5 cm. and in any case before it reaches 10 cm. By this procedure the great inconveniences attaching to the normally lengthy incubation period of the virus can be obviated. Moreover, as in the case of *Narcissus* mosaic, a diagnosis may be made in a day or two with the help of serological methods.

With a view to determining the influence of environmental and climatic factors

on the incidence of breaking, 100 to 200 bulbs of each of ten well-known commercial varieties were planted in 1937 in (1) the west of Holland, (2) the south of France, (3) Canada, (4) in a warehouse at Lisse, and (5) in the open at the same place. To cite some of the resultant data, after two years in the west, the percentages of infection in Pride of Haarlem, Farncombe Sanders, Rauwenhof, Clara Butt, Prince of Orange, Orange King, and Amber were 13·5, 2, 9·1, 10·5, 9, 2·7, 5·5, and 4, respectively, Bartigon, Ellen Wilmot, and Elisabeth being unaffected. After two years in the south of France, only Ellen Wilmot was still sound, the percentages of breaking in the remaining nine varieties ranging from 0·7 in Amber to 41·4 in Pride of Haarlem. It is of interest to note that after the first year in France only 0·35 per cent. infection had developed in Pride of Haarlem, all the other varieties being unbroken, so that the spread of the virus took place almost in its entirety in the second season.

Similarly, in the Westland series there was a marked increase of breaking in the second year, e.g., from 4 to 13·5 per cent. in Pride of Haarlem and from 1·3 to 10·5 in Clara Butt, while Farncombe Sanders and Rauwenhof were still sound in 1938. All the Canadian lots remained healthy throughout the experiment, as also did the offspring of 25 bulbs of each of 23 other varieties. Two lots of the latter planted in Holland, one indoors and another in the field, contracted a low percentage of breaking. Presumably the Canadian plants owed their immunity to the absence either of aphids or of a source of inoculum, both of which were present in the Dutch trials.

The practice of removing tulip inflorescences, either by 'decapitation' or cutting low on the stalk, at the close of flowering as a precaution against 'fire' (*Botrytis tulipae*) may result in the spread of breaking, the latter method being particularly undesirable from this point of view (1·2 to 11·8 per cent. infection).

McWhorter's antithetic virus theory of tulip breaking [ibid., xvii, p. 603] is fully discussed and criticized as introducing additional complications into an already baffling problem. If the variable symptoms of the condition cannot be interpreted simply as differences in the degree of virulence of a single virus and in the reaction to infection of the host protoplasm, then it seems more plausible to postulate the presence of two nearly related strains of the same virus than of two separate entities, the tulip colour-adding and lily latent-mosaic viruses. McWhorter's hypothesis concerning the infection of Asiatic tulips through contact with Madonna lilies (*Lilium candidum*) in Italian gardens [ibid., xvii, p. 42] is also rejected as conflicting with the known facts and necessitating an explanation of the mode of transmission of the two components of breaking.

Roguing of diseased or suspected plants should be carried out before the influx of aphids into the fields, which in Holland coincides with the onset of flowering. 'Dark' breaking is much less easily recognized than 'light', especially on dark-coloured varieties, which should therefore be inspected with extra care. Tulip stocks containing an admixture of broken plants should not be grown in the vicinity of orchards or other crops apt to be frequented by the aphid vectors of the virus agent. Under proper safeguards the cultivation of Rembrandt and other attractive broken tulip varieties may continue to be practised without unduly endangering the health of the even-coloured stocks.

Mushin (Rose). **A bacterial disease of Stocks caused by Phytomonas matthiolae.**—*Proc. roy. Soc. Vict.*, N.S., liii, 1, pp. 192–205, 1 pl., 1941. [Received December, 1945.]

This paper gives a tabulated account of an investigation into a bacterial disease of stocks (*Matthiola incana* var. *annua*) [*R.A.M.*, xvii, p. 459], reported from Brunswick Park, Victoria, in September, 1938.

The plants at first showed light green spots on the leaves, which later became

discoloured, pale green, mottled with dark green, the surface being uneven and puckered. In serious cases the plants became stunted, the stems were sometimes woody, occasionally having dark brown streaks with discoloration of the cortex. The roots remained apparently normal.

The pathogen was isolated from plants in early stages of the disease and inoculated by incision into the Imperial, Ten Weeks, and Nice varieties. On the last-named local necrotic lesions developed, splitting the cortex and stunting growth. One Nice plant, infected by needle, showed in a week light green, roundish spots about 2 mm. in diameter, with puckering of the leaves later, while another showed only small, brownish lesions at the point of inoculation. The Nice variety was the most susceptible. Evidence derived from further inoculations with cultures re-isolated from the artificially infected stocks suggested that young seedlings kept at lower temperatures were seriously susceptible, having either only local brown lesions on stems and leaves, later becoming puckered, or showing light green spots on the leaves around the points of inoculation and scattered irregularly. Following successive re-isolations the green, fluorescent bacterium was identified by means of cultural and biochemical characters. Inoculations on wallflower, lettuce, tomato, and tobacco resulted in the formation of lesions but no dwarfing or deformity.

The organism is a Gram-negative rod, occurring singly or in pairs, 0·75 to 1·1 by 1 to 3 μ, with polar flagella, forming on agar green-fluorescent colonies with entire or lobated edge, liquefying gelatine, alkalizing and coagulating milk, reducing litmus, growing on Uschinsky's, Fermi's and Sullivan's, but not on Cohn's, solutions, facultatively anäerobic, forming ammonia but not indol or hydrogen sulphide, hydrolysing starch feebly, fermenting in peptone media glucose and galactose without gas production, but not lactose, sucrose, maltose, mannite, glycerine, or salicin, fermenting in peptone free media rhamnose, glucose, levulose, galactose, mannose, glycerol, mannite, and acetic, citric, formic, lactic, malic, and succinic acids, with an optimum temperature of 20° to 24° C., a minimum below 0°, and a maximum slightly above 38·5°, a thermal death point of 52°, with a P_H range of 4·4 to 9·5, succumbing to desiccation for 7 days and exposure to direct sunlight for 30 minutes.

The organism is identified as *Bacterium matthiolae* [loc. cit.]. It is considered to belong to the genus *Phytomonas* and is renamed *P. matthiolae*. The inability of the bacteria to attack all strains of stock and their inactivation by less suitable weather conditions suggest that *P. matthiolae* belongs to sub-group II of non-sucrose-fermenters, composed of soil saprophytes and weak plant parasites. The symptoms, inoculation tests, and biochemical reactions disprove the identity of the organism with [*Pseudomonas*] *syringae* [ibid., xviii, p. 257].

Gould (C. J.). **The parasitism of Glomerularia lonicerae (Pk.) D. and H. in Lonicera species.**—*Iowa St. Coll. J. Sci.*, xix, 4, pp. 301–331, 48 figs., 1 graph, 1945.

The fungus hitherto known as *Glomerularia lonicerac* (Peck) Dearness & House, nom. nud., commonly associated with honeysuckle leaf blight [cf. *R.A.M.*, xxiii, p. 331], occurs in Massachusetts, New York, Michigan, Wisconsin, Iowa, Ontario, Quebec, Prince Edward Island, Manitoba, and New Brunswick, and has been reported from Newfoundland. Natural or artificial infection was observed on 33 (22 new) species and varieties of *Lonicera*, while infection tests also showed *Symphoricarpos albus* to be susceptible.

The disease appears in spring on the first leaves, secondary infections occurring during the remainder of the year. Affected leaves are brownish-black and are often rolled and twisted. The first sign of the fungus is a thin, white layer of basidia and basidiospores on the lower surface, often followed by a white, powdery mass of conidia.

Histological examination showed that hyphal masses were generally present in the epidermal cells above the veins or veinlets, but hyphae which protruded above the leaf surface from these masses never bore attached spores.

The basidia, 2·3 to 5·8 (average 4·4) μ broad, emerge from the stomata as straight, cylindrical structures which gradually become semi-circular and touch, or nearly touch, the leaf surface. The four conical sterigmata measure 7 to 16·4 by 1·9 to 4·7 (average 10·3 by 2·6) μ. In very moist conditions, the sterigmata continue to elongate without producing spores. The mature basidiospores are hyaline, uninucleate, and cylindrical, with rounded ends, except for an apiculus at the attached end, and measure 8·9 to 12·9 by 5·2 to 7·5 (average 10·9 by 6·6) μ. The optimum temperature for basidiospore discharge was between 14° and 21° C.; more discharge occurred at relative humidities of 89·9 and 100 per cent. than at lower ones, and the number of basidiospores discharged from an infected leaf section measuring 19 by 9 mm. was estimated at 974, 700 during 91 hours.

The conidia frequently developed in or near areas of basidial formation on similar mycelia. They also emerged through stomata and were borne on branched conidiophores measuring 2·7 to 5·1 μ wide at the top, 5·8 to 8·5 μ at the bottom, and 30·6 to 54·4 μ long. The hyaline, verrucose, binucleate spores formed in clusters of six, in three pairs. Two pairs were spherical and borne on stalks, while the other two spores were elongated, sessile, and developed at the junction of the two stalks. The outer, inner, and elongated pairs measured, respectively, 10·2 to 17, 8·5 to 13·6, and 5·1 to 13·6 by 11·9 to 22·1 μ. The outer pairs were nearly always the only spores to germinate, germination taking place by the formation of binucleate germ-tubes. The minimum, optimum, and maximum temperatures for conidial germination were approximately 2°, 22° to 25°, and 33° to 40°, respectively. Exposure to light decreased germination.

The characteristics of the basidial stage (curved, four-spored, transversely septate basidia emerging through stomata from hyphae within the leaves, not forming hymenia, and developing intracellular masses of mycelium as well as intercellular mycelium) place the fungus in the genus *Herpobasidium*. It differs from both known species, *H. filicinum* and *H. struthopteridis*, and is named *H. deformans* n. sp. (syn. *H. foliodistortum* Gould, nom. nud.) [loc. cit.].

Experimental infection followed exposure to basidiospores, but never to conidia. Infection was favoured by temperatures of 15° to 18°, relative humidity near or at 100 per cent., sustained periods of high humidity for at least two days, and the use of young leaves and lower leaf surfaces. The minimum and maximum temperatures for infection were approximately 1° and 24° to 28°, respectively.

Considerable differences in varietal susceptibility were observed, *L. japonica halliana* being apparently immune.

GARCIA (L. A. A.). **Alternaria blight of Bachelor's Button (Gomphrena globosa L.).** —*J. Agric. P.R.*, xxvii, 4, pp. 165–169, 1943.

A severe leaf and stem blight of *Gomphrena globosa* was observed near Río Piedras during the hot, humid summer of 1937, and later became epiphytotic throughout Puerto Rico. A species of *Alternaria* was isolated invariably from affected leaves and from stem tissues of plants in gardens, and also from the wild species *G. dispersa*. The leaf symptoms of this blight correspond with those reported by Togashi from Japan [*R.A.M.*, v, p. 671]. Yellowish-green spots appeared on both leaf surfaces, although more conspicuously on the upper side, and multiplied more rapidly on the lower leaves, enlarging and turning yellowish-brown, and forming concentric rings of varying shades of that colour. The tissues round the yellowish-green spots turned first dull green and later became discoloured. When the lesions ceased to develop, the yellowish-brown spot was seen to be encircled by a characteristic reddish halo. The spots were subcircular and coalesced

on enlarging, covering a great part of the leaf. Later the leaves became corrugated, rolled, and dirty brown and hung down along the stems for several days before dropping off. Some lesions on the stems gradually lost their dahlia-carmine halo and a white discoloured area remained, the lesions coalescing and circling the plant.

The fungus grew well on potato dextrose, prune, bean, and oatmeal agars. On the last-named it formed aerial, cottony, white to grey mycelium and olive-brown or ochrous sporulating hyphae which produced numerous chlamydospore-like bodies. Sporulation occurred on oatmeal agar only and in small amounts. The amphigenously produced conidiophores were 1- to 5-septate, 35 to 70 by 4 to 5 μ and usually bore single conidia. These were elongate, obclavate 60 to 160 by 12 to 16 μ, with a long, unbranched beak, one to three times the width of the spore and septated every 10 to 15 μ.

Plants inoculated with spores washed from typical lesions and from pure cultures developed within three days characteristic, yellowish-green spots, constantly associated with the pathogen.

Excision of dead or severely diseased plants, destruction by deep ploughing and burning of all diseased material, clean cultivation, good drainage, and planting during the dry season are measures recommended to check the disease.

Hardison (J. R.). **Bacterial blight of Orchard Grass observed in Oregon.**—*Plant Dis. Reptr*, xxix, 22, p. 600, 1945. [Mimeographed.]

At the grass nursery of the Oregon Agricultural Experiment Station, specimens of a bacterial head blight of orchard grass (*Dactylis glomerata*) associated with a non-motile, Gram-positive bacterium suggesting Rathay's disease, caused by *Corynebacterium rathayi* [*R.A.M.*, xiv, p. 514; xxi, p. 365] were collected in May, 1945. A yellow bacterial exudate covered much of the spikelets in affected portions of diseased panicles; in some spikelets only one or two of the florets were affected, in others all. This is believed to be the first report of the disease in the United States, but the stunting of plants, abnormal growth, and the susceptibility of the leaves described for the disease in Europe were not observed.

The disease occurred only on the Akoroa strain of orchard grass imported from New Zealand, and was presumably introduced with infected seed, three replications of this strain cultivated in the nursery showing diseased panicles. It is suggested that the disease might be sought in other plantings of orchard grass from New Zealand and European seed, particularly Danish [ibid., xii, p. 294].

Smith (O. F.). **Parasitism of Rhizoctonia solani from Alfalfa.**—*Phytopathology*, xxxv, 10, pp. 832–837, 1 fig., 1945.

At the Nevada Agricultural Experiment Station, California Common lucerne was inoculated with isolates of *Rhizoctonia* [*Corticium*] *solani* from potato, sweet clover (*Melilotus alba*), beet, and cotton, and other plants were inoculated with a strain of the fungus causing lucerne root canker in south-western Arizona and southern California [*R.A.M.*, xxiii, p. 109]. The latter produced numerous root cankers on reinoculation into lucerne, to which the isolates from other plants were innocuous, except one from beet of weak pathogenicity, expressed by a few lesions in four of 40 roots. The lucerne root fungus proved injurious to the roots of Bard vetch (*Vicia calcarata*), berseem clover (*Trifolium alexandrinum*), guar (*Cyamopsis psoraloides*), Hubara and Madrid Evergreen sweet clover, sour clover (*M. indica*), Cumberland red clover (*T. pratense*), and to the stems of Canada field peas.

Cormack (M. W.). **Studies on Ascochyta imperfecta, a seed- and soil-borne parasite of Alfalfa.**—*Phytopathology*, xxxv, 10, pp. 838–854, 2 figs., 1945.

In field, greenhouse, and laboratory studies at Edmonton, Alberta, Canada, *Ascochyta imperfecta*, the agent of lucerne, black stem [*R.A.M.*, xxi, p. 121],

parasitized the roots of its own host and other legumes, as well as lucerne seedlings, and was both seed- and soil-borne. None of the other plants investigated was so susceptible as lucerne to stem, leaf, and root infection by *A. imperfecta*, which caused only slight infection on *Melilotus alba*, *M. officinalis*, and red clover (*Trifolium pratense*), while alsike (*T. hybridum*) was even more resistant. The fungus was occasionally isolated from *Vicia americana* stems and the foliage of *Lathyrus* spp.

Cool, humid conditions favoured the development of black stem on lucerne stems, leaves, and seedlings. The roots of dormant plants were not attacked at soil temperatures near freezing point. The incidence of seed and stem infection was directly correlated. *A. imperfecta* was isolated from up to 40 per cent. of the seeds of 49 out of 97 random samples. The fungus was abundant in the surface soil of lucerne fields, but disappeared two years after ploughing, nor was it isolated from the soil of cereal rotations, virgin prairie, or virgin woods. It persisted on dry lucerne stems and leaves for at least five years, and on the seed for about three. New improved ceresan, diluted to 1 per cent. ethyl mercury phosphate, and arasan were the most effective of the seed treatments tested.

No evidence of host specificity was obtained in these studies, similar differences in virulence and cultural characters being exhibited by isolates from various hosts, different parts of the same plant, and soil.

Among the Ascomycetes found in association with the pycnidia of *A. imperfecta* on overwintered lucerne stems was a *Pleospora* closely resembling *P. rehmiana*, described as the agent of the same disease in Idaho [ibid., xvi, p. 184], but proof of a genetic connexion could not be established and it is concluded that the two states are not related.

Roberts (W. O.). **Leaf painting as a method of diagnosis of mineral deficiency.**—*Rep. E. Malling Res. Sta., 1944*, p. 67, 2 figs. (facing p. 68), 1945.

In tests of the diagnosis of trace-element deficiencies by leaf-painting, peas in an area likely to be deficient in manganese were treated by painting the leaflets on one side of the last fully expanded leaf with manganese sulphate solutions ranging in strength from 0·025 to 5 per cent., plus 0·1 per cent. spreader, the remaining half on the other side of the midrib being left untreated. Each treatment was applied four times. Nine days later, all the four leaves painted with 0·5 per cent. manganese sulphate were a darker green on the painted than on the unpainted side.

When leaves on a cherry tree known to be deficient in manganese were painted with manganese sulphate the best response was obtained at 0·5 per cent. on two occasions.

The method appears to merit further trial as a routine method of diagnosis for trees which do not absorb injected liquid satisfactorily.

Roberts (W. O.). **Combined mineral deficiencies in fruit trees.**—*Rep. E. Malling Res. Sta., 1944*, pp. 64–67, 1 map, 1945.

In recent years, a serious deficiency of potassium, combined, in most cases, with a deficiency of one or more trace elements, has caused a die-back of apple, pear, and plum trees in widely separated areas of eastern and southern England. Leaf analyses supported this diagnosis and showed the trees to be low in potassium, iron, and/or manganese, while in six cases boron was low. Three stages in the condition were noted on apple in 1944: (1) the leaves were small, brittle, grey-green, the fruit was usually small, the young wood was grey, and growth was often poor, the tree progressively losing its lustrous, healthy appearance; (2) the basal leaves of extension growths became discoloured, and showed marginal scorch and rotting; there was internal chlorosis of spur and other leaves, and a yellowing of leaves at the tips of extension growth shoots; branches about to die showed a blistering and wrinkling of the bark, which was of a very unnatural colour; and

(3) rapid die-back set in. On pear, the leaf edges turned dark brown or black, the leaves were small and brittle, and the edges were curled parallel to the midrib; some had a pinkish hue. The bark became blistered and showed an unhealthy colour, and when lifted, revealed a blackened area round the base of the leaf stalk.

It is considered that the potassium deficiency results from the war-time shortage of potassic manures, while the trace-element deficiencies are due to the calcareous nature of the soils or to calcareous applications and low organic matter.

Preliminary experimental injections of the necessary nutrients in solid form have given encouraging results and further trials are to be made in an attempt to find a rapid cure.

GARNER (R. J.) & ROACH (W. A.). **Comparative susceptibilities of certain horticultural and agricultural plants to trace element deficiencies.**—*Rep. E. Malling Res. Sta., 1944*, pp. 70–73, 2 figs., 1945.

When 13 different kinds of crops were grown on a highly calcareous peat, they showed a wide range of susceptibility to trace-element deficiency. The most outstanding difference was between potatoes and oats on the one hand and willows (*Salix vitellina 'goldenensis'*) on the other. The potatoes and oats were severely affected by manganese deficiency, and the willows, also severely, by iron deficiency, though their symptoms were characteristic of manganese deficiency in fruit trees. Boysenberries [*Rubus ursinus* var. *loganobaccus*] showed symptoms characteristic of iron deficiency in fruit trees, but were proved to be affected by manganese deficiency. An inverse relationship was observed between severity of symptoms and yield of crop in potatoes, oats, peas, and willows. The results suggest caution in the use of indicator plants in diagnosing deficiencies in plants not exhibiting specific symptoms.

THOMPSON (S. G.). **The cure of deficiencies of iron or manganese.**—*Rep. E. Malling, Res. Sta., 1944*, pp. 119–123, 1 fig., 1945.

In this paper the author discusses in popular terms the methods that growers can adopt for curing iron or manganese deficiency in apples, pears, plums, cherries, and peaches. Soil applications are of little or no value, and the choice lies between injections and sprays. Both are effective, and which should be adopted depends on the circumstances and on a number of considerations which are reviewed.

BOYNTON (D.). **Studies on the control of magnesium deficiency in New York Apple orchards.**—*Proc. Amer. Soc. hort. Sci.*, xlvi, pp. 1–5, 1945.

In spraying tests carried out on Baldwin apple trees against leaf blotch due to magnesium deficiency, the data obtained indicated (from leaf analyses) that two cover sprays including 16 lb. high magnesium hydrated lime (30 per cent. Mg O) per 100 gals. water were as effective in increasing leaf magnesium as two sprays including 16 lb. Epsom salts [magnesium sulphate]. Such a heavy dosage of spray lime leaves a white deposit on the leaves and young fruits, and may decrease the effectiveness of arsenicals.

SOUTHWICK (L.) & SMITH (C. T.). **Further data on correcting magnesium deficiency in Apple orchards.**—*Proc. Amer. Soc. hort. Sci.*, xlvi, pp. 6–12, 1945.

In further work carried out in Massachusetts on the effects of spray and soil applications of magnesium on magnesium-deficient apple trees [*R.A.M.*, xxiv, p. 322; see also preceding abstract], the inclusion of 20 lb. Epsom salts [magnesium sulphate] per 100 gals. spray in three early-season applications to some extent prevented the development of 'leaf scorch' in the year of application. This treatment appeared to be particularly valuable for trees slow in responding to soil applications of magnesium. As a temporary means of controlling magnesium deficiency it has a definite place, especially in mature orchards.

Soil applications of Epsom salts and kieserite were advantageous in young mulched blocks, but one application of dolomite, kieserite, or Epsom salts was ineffective in a seriously deficient bearing orchard under sod culture. Commercial magnesium oxide (92 per cent. Mg O) appeared to give greater increases of magnesium in leaves of young apple trees than did Epsom salts applied in similar amounts by weight. Commercial dolomite [magnesium limestone] appeared to be less beneficial than other materials, except when applied together with Epsom salts.

CHUCKA (J. A.), WARING (J. H.), & WYMAN (O. L.). **Magnesium deficiency in Maine Apple orchards.**—*Proc. Amer. Soc. hort. Sci.*, xlvi, pp. 13–14, 1945.

After pointing out that in Maine apple 'leaf scorch' and 'magnesium deficiency' are commonly used as referring to one and the same condition, the authors briefly describe investigations carried out to determine the cause and possible control of the trouble. The data obtained indicated that apple orchards on soils low in magnesium should be treated preventively with dolomite limestone. Orchards already affected by leaf scorch should be similarly treated, and, in addition, should receive sprays containing 20 lb. Epsom salts [magnesium sulphate] of spray material per 100 gals. until the magnesium in the limestone applied has become available.

BEAKBANE (A. BERYL) & THOMPSON (ELEANOR C.). **Recognition of 'rubbery' condition in Lord Lambourne and some other Apple varieties.**—*Rep. E. Malling Res. Sta., 1944*, pp. 108–109, 1 fig., 1945.

A staining method for detecting 'rubbery wood' [*R.A.M.*, xxiv, p. 423] (the cause of which has not yet been determined) in Lord Lambourne and certain other apple varieties is described. As much solid phloroglucinol as will go on a sixpence is added to two-thirds of an eggcupful of water, and the solution then added to one-third of an eggcupful of concentrated hydrochloric acid. A cross-section of the stem, about ¼ in. thick, is cut off. The bark is removed with the thumb nail and the section placed in a glass dish and covered with the solution. Normal wood becomes red all over after about five minutes, whereas 'rubbery' wood displays white areas. As the abnormality is not readily detected without the aid of a microscope in thin, one-year old lateral shoots, it is advisable, when examining orchard trees, to test wood two years old or more. If the test is used to survey nurseries of maiden trees, sample maidens should be tested at the base of the scion shoot, the symptoms being much more difficult to detect at the top.

PIENIAZEK (S. A.) & CHRISTOPHER (E. P.). **Effect of pre-storage treatments on the incidence of scald of Rhode Island Greening Apples.**—*Proc. Amer. Soc. hort. Sci.*, xlvi, pp. 123–130, 1945.

Studies in the control of storage scald of Rhode Island Greening apples [*R.A.M.*, xxiv, p. 444] showed that delayed storage, the fruits being maintained for 10 or 20 days at 78° F., prevented the trouble, but in most cases impaired the flavour [cf. next abstracts]. Ammonia and acetic acid vapour, used as short pre-storage treatments, were without effect on scald, but sealing in tight jars for a few days at storage and room temperatures before storage usually prevented scald provided the treatment was sufficiently prolonged. Pre-storage in atmospheres of 30 and 60 per cent. carbon dioxide at room temperatures for one to four days gave some control of scald, but the results were not uniform. Similar pre-storage treatment at 32° for three, six, and ten days gave very good control with no loss of flavour. No recommendations are given on these experiments, as further data are required.

ESBJERG (N.). **Opbevaringsforsøg med Æbler og Pærer af Høst 1938 og 1939. Forsøg med Opbevaring under forskellige Lagerforhold II.** [Preservation experiment with Apples and Pears of the 1938 and 1939 harvests. Experiments in preservation under various storage conditions II.]—*Tidsskr. Planteavl*, xlv, 4, pp. 565–622, 6 figs., 1941. [English summary. Received January, 1946.]

Further experimental data are summarized and tabulated in connexion with the health of apples (pears also being included in the present series of trials) under various storage conditions in 1938–9 and 1939–40 in Denmark [*R.A.M.*, xviii, p. 118 and preceding and next abstracts], viz., an ordinary ventilated storeroom and a cold store at temperatures of 3·5°, 2·5°, 1·5°, and (in the latter year) 0·5° C., while the effects of pre-cooling (by keeping the fruits at 2·5° for 10 or 20 days before placing in the ventilated storeroom) and of delayed cooling (10 or 20 days in the ventilated storeroom before transference to the cold store) were also determined.

Ten days' pre-cooling and cold storage improved the keeping properties of Bellefleur de France apples of the 1938 harvest until January or February, but by March or April the position had deteriorated in respect of scald and low-temperature breakdown, which were more severe in cold than in ordinary storage, while brown heart occurred only under the former conditions. In 1939 scald and brown heart were again more troublesome at the lower temperatures in the cold store during the latter part of the storage period. In contrast to 1938, delayed cooling improved the keeping properties of Bellefleur.

Both in 1938 and 1939 Bismarck kept best at low temperatures. In the former year, brown heart affected all the fruits in each series, while in the latter it was reduced under the influence of the lowest temperatures of 1·5° and (more especially) 0·5°. The maximum incidence of fungal infection (21 per cent.) occurred in 1938 in the ordinary storeroom without pre-cooling, *Botrytis* [*cinerea*], *Penicillium*, and *Gloeosporium album* being the organisms mainly concerned.

Blenheim was likewise benefited by cooling and pre-cooling in both years, except in respect of brown heart, which was aggravated at low temperatures. Scald occurred in the ordinary storeroom in both seasons, Jonathan spot in 1938–9 only.

In both years scald was more severe in Filippa in the ordinary storeroom and Jonathan spot in cold storage. Fungal infection was present under the former conditions, especially in 1938–9, but was greatly reduced by pre-cooling.

Gravenstein sustained severe injury from low-temperature breakdown in cold storage, while brown heart was also destructive under similar conditions, especially in 1938–9. In both years scald was more prevalent in ordinary, and Jonathan spot in cold storage. Fungal infection in the ordinary storeroom was reduced by pre-cooling in the former year, while in the latter it was relatively unimportant.

Nonnetit suffered heavy damage from Jonathan spot in cold storage especially in 1939–40 and without a preliminary period in the ordinary storeroom; in 1938–9 the trouble was intensified by pre-cooling. Scald was severe in the ordinary storeroom in the earlier year, especially where cooling was omitted.

In both seasons pre-cooling enhanced the keeping properties of Pederstrup, while delay in exposure to low temperatures impaired them. Scald and Jonathan spot occurred in the ordinary storeroom in both seasons, the latter also to a slight extent in the cold store in 1938–9.

Scald was prevalent in the Sønderskov variety in the ordinary storeroom, especially in the absence of pre-cooling.

In nearly all the tests on pears the advantages of cold storage were manifest, but the difficulty of achieving satisfactory results is much greater than in the case of apples, and a number of critical points remain to be settled before proceeding with the method.

Esbjerg (N.). **Forsøg med Opbevaring af Æbler og Pærer i Kulsyrerum og andre Lagerrum 1936–41. Forsøg med Frugtopbevaring under forskellige Lagerforhold III.** [Experiments in the preservation of Apples and Pears in gas storage and other storage rooms 1936–41. Experiments in fruit preservation under various storage conditions III.]—*Tidsskr. Planteavl*, xlvi, 3, pp. 426–494, 8 figs., 3 diags., 1942. [English summary. Received January, 1946.]

From this very full discussion, amplified by 46 tables, of the comparative incidence from 1936 to 1941 of various storage diseases on a number of standard apple varieties held in gas, cold, and ordinary storage [see preceding and next abstracts], it would appear that Nonnetit, Filippa, Gravenstein, Bramley's Seedling, and Codling Springrove are the best adapted for keeping in gas storage.

Esbjerg (N.). **Forsøg med Præservering af Æbler. Forsøg med Frugtopbevaring under forskellige Lagerforhold IV.** [Experiments in Apple preservation. Experiments in fruit preservation under various storage conditions. IV.]—*Tidsskr. Planteavl*, xlvii, 2, pp. 306–325, 1942. [Received January, 1946.]

Various preparations were tested between 1934 and 1941 for their applicability to the skin of apples as a means of combating storage disorders in Denmark [see preceding abstracts]. Gerner's solution, consisting of shellac, castor oil, paraffin oil, and sandarac dissolved in alcohol and methyl alcohol, appreciably reduced the incidence of fungal infection, but increased that of brown heart and gave conflicting results in respect of Jonathan spot and scald. In a small-scale trial to determine the relative merits of 2 per cent. paraffin, cod liver, sunflower, and soya oil emulsions as coatings for Bellefleur de France apples, sunflower was the most effective and paraffin the least, the former practically equalling the standard oiled paper wraps. The results of the experiments with sterisol (chloramine) and diatomol were inconclusive or unsatisfactory.

Smolák (J.). **Příspěvek k poznání sklovitosti Jablek.** [A contribution to the study of water-core disease of Apples.]—*Rozpr. České Acad.*, liv, 26, 12 pp., 1 col. pl., 16 figs., 1945. [With a shorter English version in *Bull. int. Acad. Prague*, liv, 4 pp., 1 col. pl., 7 figs., 1945.]

This study of the cytology and etiology of the water-core disease of apples [*R.A.M.*, xix, pp. 290, 353] revealed the presence of a bacterium in affected tissues, which the author regards as the agent of the disease and names *Bacterium mali* [without a diagnosis].

The intercellular spaces in the affected tissues of the diseased apples were much larger than in healthy fruit and the nuclei of the part attacked sometimes assumed an irregular or amoeboid form as if corroded. The diseased tissue behaves as if parasitized and morphologically resembled gall-tissue. The enlargment of the intercellular spaces is attributed to their being filled with a curious zoogloea, containing immense numbers of bacteria, which are considered to expel the air and occupy its room in the intercellular spaces. This occurrence of bacteria-filled zoogloeae was observed in all the watery parts of affected fruit. Isolation experiments yielded on many occasions a short rod rounded at the ends and slightly bent, morphologically identical with that observed in the intercellular spaces. The crowded colonies, with a faint yellowish tinge, become visible after 36 hours. Only one attempt to inoculate a healthy apple with the organism has so far succeeded, but nevertheless the author believes the disease is a form of bacteriosis.

Wormald (H.). **A black Apple rot caused by Monilia cinerea.**—*Rep. E. Malling Res. Sta., 1944*, pp. 75–76, 1 fig., 1945.

A fungus isolated from an apple affected by black rot, when inoculated into apples, pears, and damsons gave rise to fructifications of *Monilia cinerea*

(*Sclerotinia laxa*). A further experiment demonstrated that the fungus produced the black-apple condition on Bramley's Seedling kept in the dark, but not on King Edward apples even when kept in the dark. Black rot, therefore, may be caused not only by *S. fructigena* but also by *S. laxa*.

[This paper is reprinted from *Gdnrs' Chron.*, Ser. 3, cxvii, p. 115, 1945.]

THOMPSON (S. G.) & ROBERTS (W. O.). **Progress in the diagnosis and cure of mineral deficiencies in Cherries.**—*Rep. E. Malling Res. Sta., 1944*, pp. 60–63, 3 figs., 1945.

Experimental evidence indicated that a winter (February) spray of (say) 5 per cent. manganese sulphate gives better control of manganese deficiency of cherries in the current season than does a summer spray, but the effect is no longer apparent after one year.

A second experiment concerned cherries with multiple deficiencies. The foliage was a dull yellow with no pattern, and no scorching or necrosis. Analysis of leaf material indicated that iron, manganese, and zinc were low, calcium high, and potash and phosphorus normal. A branch injected with solid iron sulphate in June, 1944, still showed improvement in the early summer of 1945, as did manganese- and zinc-injected branches, though one injected with boron made no progress. Leaves from branches injected with iron, manganese, and zinc all showed chlorosis, which differed with the treatments. A branch injected with iron plus manganese had foliage of a better colour than that produced by either element alone, but a slight deficiency pattern was present. A branch injected with iron, manganese, zinc, and boron in 1944 showed striking improvement, with no sign of chlorosis and a full crop, whereas the rest of the tree was still very chlorotic. New growth occurred in 1945 on the branches injected with iron, manganese, zinc, and boron together, iron and manganese, and iron alone, while no growth followed manganese only. The view was taken that iron was the main deficiency, manganese secondary, and zinc a minor deficiency. A series of trees was, accordingly, given whole tree injections of iron, manganese, and both together, while two other series received dormant sprays of iron and manganese. So far, the injections of iron plus manganese have given the best results, both iron and manganese alone have given great improvement, iron sprays have resulted in some improvement, and the manganese sprays appear to have had no effect. It is pointed out that diagnosis by leaf symptoms alone may lead to serious errors in cases of complex deficiencies and other means of diagnosis are desirable under these circumstances.

GERHARDT (F.), ENGLISH (H.), & SMITH (E.). **Cracking and decay of Bing Cherries as related to the presence of moisture on the surface of the fruit.**—*Proc. Amer. Soc. hort. Sci.*, xlvi, pp. 191–198, 7 graphs, 1945.

The cumulative effect of rains over a four-day period at harvest caused a progressively greater amount of cracking in Bing cherries the longer the fruit remained on the tree. Increased decay (associated with *Alternaria* sp., *Botrytis cinerea*, *Cladosporium herbarum*, *Penicillium expansum*, *Rhizopus* spp., *Sclerotinia fructicola*, and other fungi) and the loss in weight of the rain-damaged fruit after picking were directly correlated with intensity of cracking and time of harvesting. The process of healing of cracked cherries is largely a drying-out of the exposed tissue and not a true healing-over by cork formation. No 'healing' occurred during storage at 40° F. for ten days.

The condensation of moisture (sweating) on the surface of cherries moved from a cold to a warm atmosphere is generally thought by warehousemen to favour decay, but such condensation on Bing cherries kept at 40° did not increase rotting, though short periods at 50° without sweating caused significant increases. The failure of sweating to increase decay is explained by the fact that the moisture on the surface

of the fruit was not retained long enough to permit the germination of fungus spores. Hydro-cooling with iced water at 32° for 30 minutes did not injure the fruit, the appearance of which resembled that of cherries cooled in air at 32°, with a relative humidity of 85 per cent.

RHOADS (A. S.). **Symptom expression of rusty mottle in Utah Sweet Cherry orchards.** —*Plant Dis. Reptr*, xxix, 22, pp. 613–614, 1945. [Mimeographed.]

A survey of Utah sweet cherry orchards in September, 1944, disclosed a necrotic spotting of the leaves so slight as to cause doubt as to whether the characteristic symptoms of rusty mottle [*R.A.M.*, xx, p. 25; xxiii, p. 391] were actually present. It was followed, however, in mid-June of 1945, after a growing season delayed by prolonged cold, rainy weather, by an onset of the disease so severe that large portions of the leaves were killed as a result of profuse spotting, which rapidly became confluent. It is concluded, therefore, that an apparently negligible occurrence of the characteristic necrotic spotting on leaves of Utah sweet cherries justifies a diagnosis of attack by the cherry rusty-mottle virus.

WORMALD (H.). **Strawberry leaf blotch fungus.**—*Rep. E. Malling Res. Sta., 1944*, pp. 76–77, 1945.

This is a reprint of a paper on *Zythia fragariae* already noticed from another source [*R.A.M.*, xxiv, p. 24].

HARRIS (R. V.). **Plant pathology.**—*Rep. E. Malling Res. Sta., 1944*, pp. 26–28, 1945.

The following items may be noted from this report [*R.A.M.*, xxiv, p. 137]. Tests of Lloyd George raspberry stocks carried out at East Malling in 1943 did not reveal the presence of any free from virus, and suggested the existence of an unsuspected virus carried by this variety, which produced leaf-curling and dwarfing symptoms on Baumforth's Seedling B. Tests of the virus reactions of four additional seedling varieties were begun, together with further work on those of Norfolk Giant. The testing and maintenance of selected stocks of commercial strawberry varieties were continued. Among the newer varieties, Early Cambridge was sensitive to yellow edge [loc. cit.], while Perle de Prague was intermediate.

SUIT (R. F.). **Control of spur blight of red Raspberries.**—*Bull. N.Y. St. agric. Exp. Sta.* 710, 14 pp., 2 figs., 1945.

During investigations conducted from 1938 to 1944 into the incidence and control of spur blight (*Didymella applanata*) [*R.A.M.*, xxii, p. 290], a disease causing at times severe losses in New York State, three years' data showed Indian Summer and Taylor varieties as very susceptible; Newburgh, Latham, and Milton moderately susceptible; and Ontario, Viking, Cuthbert, Marcy, and Chief slightly susceptible.

Under proper cultural methods, carefully carried out with a view notably to assuring that the plants in respect of spacing and the location of the planting to air drainage are able to dry off readily after rainy weather, no fungicidal control is required by the least susceptible varieties.

In the case of susceptible varieties, two applications of fermate, 2–100, the first when the new shoots were some 12 in. high and the second a fortnight later, gave perfect control on Indian Summer. U.S.K. No. 604, 1 in 100, or $\frac{1}{2}$ in 100, and dithane 1 in 100, gave excellent control but are only available for experimental work. If fermate is not obtainable, the next best treatment is elgetol at 1 per cent. applied at the green-tip stage in the spring, which should reduce disease occurrence except with Indian Summer, and subsequent treatment with Bordeaux mixture, 3–3–100, when the new shoots are about 12 in. high, increased control. Cover

sprays, such as fermate, should be directed at the new shoots, care being taken to avoid the fruiting cane as far as possible.

KUNKEL (L. O.). **Studies on Cranberry false blossom.**—*Phytopathology*, xxxv, 10, pp. 805–821, 3 figs., 1945.

The cranberry false-blossom virus [*R.A.M.*, xxiii, p. 317] was transmitted by dodder (*Cuscuta campestris*) from its own host to 28 species of plants belonging to ten families, including parsnip, celery, parsley, carrot, *Vinca rosea*, *Phlox drummondii*, *Petunia hybrida*, tomato, tobacco, *Nicotiana glutinosa*, *N. langsdorffii*, *N. rustica*, potato, *Scabiosa atropurpurea*, *Gaillardia aristata*, *Tagetes erecta*, *Calendula officinalis*, and salsify (*Tragopogon porrifolius*). It was transmitted by the same agency from *V. rosea* and tomato to cranberry. The virus was retained by dodder growing on healthy plants over a two-year period, and apparently multiplies in this vector. Transmission was further effected by grafting to *V. rosea*, Turkish tobacco, tomato, potato, *N. glutinosa*, and *N. rustica*, but not by means of juice from diseased plants, by the aster leafhopper (*Macrosteles divisus*), or through dodder seeds produced by the parasite in the course of growth on an infected tomato plant.

Symptoms of the yellows type developed in all the species to which the false-blossom virus was conveyed, while many also showed signs of gigantism in the flowering and fruiting organs, and sterility was a feature of infected potatoes.

In *V. rosea* and cranberry false blossom was cured by heat treatments [ibid., xxi, p. 340], an eight-day exposure to a temperature of 42° to 43° being recommended, for the latter host.

It is thought probable that cranberry false blossom is closely related to tomato big bud in the United States and Australia [ibid., xxii, p. 457], 'stolbur' [big bud] of the same host in the U.S.S.R. [ibid., xiii, p. 133], and little leaf of eggplant in South India [ibid., xix, pp. 61, 259].

IVANOFF (S. S.). **Deterioro interno no parasitario de la Piña.** [Non-parasitic internal breakdown of Pineapple.]—10 pp., 3 figs., Mexico [City], Secretaria de Agricultura y Fomento, 1945. [Mimeoprinted.]

Pineapple fruits sent by rail from Mexico to the United States often develop on arrival or subsequently a non-parasitic internal breakdown, which renders them worthless. The author studied the disease at Loma Bonita, Oaxaca, the chief pineapple-growing area of Mexico.

Affected fruits generally appear normal on the outside, but are discoloured internally. The first symptoms are slight, water-soaked spots at the base of the fruitlets, resembling in cross-section the size and form of a watermelon seed. The affected tissue enlarges and darkens to a light to very dark chocolate colour. The enlarged area of diseased tissue, which at first is relatively firm, may extend to the core and outwardly towards the rind. The core may darken, but generally remains unaffected. The darkened fruit may soften to a watery consistency, and in the final stages it disintegrates.

A test was carried out in which Cayenne pineapples were harvested at three different stages of progressive ripeness, 'tres-cuartos', 'sazona', and 'pintona', and some of each lot dipped in dithane-zinc-lime solution (dithane 2 qts, zinc sulphate 1 lb., lime $\frac{1}{2}$ lb., and water to 100 gals.), or in water, while others remained untreated. A very few were dipped in Du Pont IN–200[3] suspension and in paraffin. 'Sazona' fruits were treated in addition with benzoic acid-alcohol solution (benzoic acid 2·59 [per cent.], alcohol 30 c.c., water 70 c.c.), by smearing the cut stem end. Some of the fruits were loaded in an ordinary box car, others in an iced car, while the remainder were stored at room temperature. During the ten days' transit from Loma Bonita to Laredo, Texas, the temperature in the iced car ranged from 7° to 25° (average 15·1°) C. and that in the box car from 11° to 28° (average 20°).

On arrival, breakdown was most common in the untreated lots in the box car, the figures for the 'tres-cuartos', 'sazona', and 'pintona' fruits being, respectively, 76, 51, and 23 per cent. With one, probably insignificant exception, all the lots, both treated and untreated, showed less breakdown in the iced than in the uncooled car. Twenty days after loading, however, the fruits in the iced car showed greater damage than those in the uncooled one, the differences being greater in the 'tres-cuartos' fruits than in the more mature ones. On the whole, the fruits treated with dithane-zinc-lime showed less breakdown than untreated, as did fruits dipped in water. The benzoic acid-alcohol treatment appeared to have no significant effect on breakdown.

In the fruits kept at room temperature, the 'tres-cuartos' showed more decay (apparently not internal breakdown) than the others, in all treatments. The dithane-zinc-lime 'sazona' fruits showed much less decay than untreated fruits. The benzoic acid-alcohol treatment and the water-dip of 'sazona' fruits considerably reduced decay. Fruits treated with paraffin or Du Pont IN-200[3] showed no decay after 20 days.

The condition appears to be associated with stage of maturity at harvest and temperature in transit. Greener fruits are more susceptible after transit at low temperatures than more mature ones. The lower temperatures of the iced car reduced the trouble, but these fruits, if kept for a week or ten days at room temperature, seemed to break down more rapidly than uncooled ones. Treatment with benzoic acid-alcohol solution should be continued, against fungal rots. Pineapples sent by boat arrived in Texas in fairly good condition after three to four days' transit at a uniform temperature. Such shipments avoid exposure to the low temperatures of the Mexican plateau and are of much shorter duration than rail shipments, which take eight or nine days.

Hopkins (E. F.), Pagán (V.), & Ramírez Silva (F. J.). **Iron and manganese in relation to plant growth and its importance in Puerto Rico.**—*J. Agric. P.R.*, xxviii, 2, pp. 43–101, 10 figs., 9 graphs, 1944.

Studies [which are fully described] carried out in Puerto Rico on the toxicity of manganese to plant growth and on the mechanism by which iron antidotes this toxicity showed that pineapple soils may contain, locally, up to 130 p.p.m. water-soluble manganese and no water-soluble iron. Pineapple plants growing in these soils require to be sprayed with iron sulphate to prevent severe chlorosis and death [*R.A.M.*, xx, p. 565].

One reason for the presence of high amounts of soluble manganese in the soil is the continued use of ammonium sulphate, which frequently reduces the P_H value of the soil to 4 or under. Adjustment of this figure to 6·2 immobilized the manganese or made it insoluble to such an extent that the available iron sufficed to antidote its toxicity as regards chlorosis. The addition of iron in organic combination improved the condition still more.

To detect conditions conducing to manganese toxicity in soils, common bean [*Phaseolus vulgaris*] plants were grown in them, and in 10 days, when the first trifoliate leaves opened, symptoms of chlorosis appeared, and the approximate severity of the condition was determined.

Extensive water cultures and sub-irrigation gravel culture experiments were made with beans, tomatoes, and pineapples. Chlorosis, necrosis, sun scald, and decreased growth were strikingly associated with low iron and high manganese content.

Sinha (S.). **Studies in the diseases of Mangifera indica Linn. V. The structure and development of lenticels in the Mango fruits.**—*J. Indian bot. Soc.*, xxiv, 3, pp. 119–127, 29 figs., 1 pl., 1945.

This paper describes the structure and development of lenticels in the mango,

based on the examination of epidermal peelings obtained after soaking the tissues in various solutions [*R.A.M.*, xi, p. 658].

PARRIS (G. K.). **The nematocidal and fungicidal value of D-D mixture and other soil fumigants.**—*Phytopathology*, xxxv, 10, pp. 771–780, 1945.

Disappointing results were given by attempts at the Virginia Truck Experiment Station to eliminate the damping-off fungi of spinach and peas, *Rhizoctonia* sp. (probably *R.* [*Corticium*] *solani*) and *Fusarium* sp. (? *F. martii*), *Pythium aphanidermatum*, the agent of post-emergence damping-off of beans [*Phaseolus vulgaris*], and the tomato-wilt fungus, *F. oxysporum* f. *lycopersici* [*F. bulbigenum* var. *lycopersici*], from various types of soil ranging from Norfolk loamy sand to Woodstown silt loam, by the effective nematocide dichloropropylene-dichloropropane, *Pythium aphanidermatum* withstanding dosages up to 550 lb. per acre and the other organisms surviving rates as high as 1,000 lb. Two other materials of similar chemical composition, viz., monochlorobutenes and trichlorobutanes, were also devoid of fungicidal properties. On the other hand, good to excellent control of damping-off in spinach and peas was given by arasan and spergon, respectively, both at 2 per cent. by weight [*R.A.M.*, xxiii, pp. 510, 511].

HORSFALL (J. G.). **Fungicides and their action.**—239 pp., 2 figs., 17 diags., 5 graphs, Waltham, Mass., The Chronica Botanica Co.; London, William Dawson & Sons, Ltd., 1945. $5.

In this work (to which D. Fairchild contributes a foreword), the main purpose of the author is to discuss, in the light of the chemistry and physiology of toxic action and of the mechanics of application, how to procure the proper materials for destroying fungi and how to apply them in sufficient quantity when and where the fungus is vulnerable. In general, the illustrative examples are taken from the field of plant pathology, but wood and fabric preservation, human pathology, bacteriology, and entomology are also drawn on. The book does not attempt to deal with practical questions of treatment, such as spray schedules, but aims rather at developing the underlying theory on which practice is based and by which it may be improved.

The matters dealt with by the sixteen chapters into which the work is divided include historical introduction, general concepts, laboratory assay [*R.A.M.*, xxiv, p. 424], data assessment, principles of chemical protection, deposition, coverage of single and multiple surfaces, tenacity, artificial immunization and chemotherapy, action of copper, sulphur, organic nitrogen compounds and other organic compounds, antagonism and synergism [ibid., xxiv, p. 327], and phytotoxicity. The bibliography extends to 23 pages, and both a general index and an index to authors are provided.

KLINKENBERG (CAROLINE H.). **Abnormale kurkvorming.** [Abnormal cork formation.]—Thesis, Univ. Amsterdam, 117 pp., 1 pl., 4 figs., 1 diag., 1940. [Received November, 1945.]

An exhaustive study was made at the Willie Commelin Scholten Phytopathological Laboratory, Baarn, of three forms of abnormal suberization, viz., (1) cork spots on the foliage of herbaceous plants; (2) different types of brown spots in apple flesh, variously known as (*a*) drought spot, internal cork, corky core, and corky pit and (*b*) bitter pit; and (3) corky roots of tomatoes.

On the leaves and stems of the herbaceous plants examined, which comprised a large number of Crassulaceae, Cactaceae, and succulents and non-succulents of other families, cork spots invariably developed round a necrosis, the form and extent of which determined the depth of penetration of the suberized areas. In some cases the thin-walled parenchyma cells alone are involved in the formation of the cork-layer, in others the thick-walled cells are also implicated.

The condition described by Banga [*R.A.M.*, xviii, p. 398] as 'storage pit' was observed in apples of the Brabant and Westland Bellefleur, Goudreinette, Kesterens Wijnzuur, Lemoen, Zoete Paradijs, and Reinette du Chené varieties, while 'tree pit' was present in Allington Pippin, Oranjereinette, and Early Victoria. In no case were any of the symptoms associated with boron deficiency detected, nor did cork enter into the composition of the necrotic storage or 'tree pit' spots. The healthy tissue on the fringe of the necrotic areas may react by the formation of callus strands and, very rarely, of a phellogen producing a few layers of small suberized cells.

Severe damage may be caused in Holland by a corky condition of tomato roots, which was also reported from the Lea Valley in 1928 and investigated by P. H. Williams at the Cheshunt Agricultural Experiment Station, where it was designated 'corky scab' [ibid., ix, p. 69]. The diseased roots contain necroses both in the outermost and underlying layers of the cortex, pericycle, and xylem, and round these necroses are formed rows of strongly suberized cells, in consequence of which the root undergoes characteristic disorganization. The pathological anatomy of 'corky scab' in tomatoes presents certain analogies with that of plants attacked by viruses, notably lupins suffering from 'sore shin' [pea mosaic virus: ibid., xxiii, p. 301]. It is considered probable, though not yet demonstrated, that 'corky scab' is caused by a virus, and a close parallel is further suggested between the tomato root disease and brown rot of tobacco [ibid., xviii, p. 634; xxiv, p. 405].

'Corky scab' may be induced in tomatoes by growing them in soil infested either by the previous cultivation of affected plants or by the admixture of diseased roots.

WHITE (A. G. C.), KRAMPITZ (L. O.), & WERKMAN (C. H.). **On a synthetic medium for the production of penicillin.**—*Arch. Biochem., N.Y.*, viii, 2, pp. 303–309, 1945.

In experiments on penicillin production at the Industrial Science Research Institute, Iowa State College, *Penicillium notatum* on a chemically defined medium yielded 80 to 90 per cent. of the titre obtained on the usual maize steep liquor medium. Maize steep liquor was fractionated and some properties of the stimulatory material determined. It is soluble in 60 per cent. alcohol, not hydrolysable in 30 per cent. sulphuric acid or 30 per cent. sodium hydroxide, largely precipitable by picric acid, and not extractable by butyl alcohol after 180 hours. Three amino-acids, arginine, histidine, and glutamic acid, in concentrations of 30, 30, and 400 mg. per 100 ml., respectively, appear to provide a large percentage of the stimulatory activity inherent in maize steep liquor.

PRATT (R.). **Influence of the proportions of KH_2PO_4, $MgSO_4$, and $NaNO_3$ in the nutrient solution on the production of penicillin in surface cultures.**—*Amer. J. Bot.*, xxxii, 8, pp. 528–535, 6 diags., 2 graphs, 1945.

A study of the accumulation of penicillin in cultures of *Penicillium notatum* [see preceding abstract] in 65 different nutrient solutions demonstrated that for a given level of phosphate ions, as the concentrations of magnesium and sulphate ions were raised, it was necessary to reduce the concentration of nitrate ion. From the standpoint of penicillin production, the best solutions contained not less than 8 millimoles of potassium dihydrogen phosphate and not more than 20 of sodium nitrate per l. The absolute concentrations in the optimum solution in this series were potassium dihydrogen phosphate, 0·019 M; magnesium sulphate 0·002 M; and sodium nitrate 0·019 M, the proportions of the three salts being 0·475, 0·05, and 0·475, respectively. In a series of solutions with these relative concentrations for the three salts, maximum potency on the seventh day resulted at a total salt concentration of 0·12 M.

PRATT (R.) & DUFRÉNOY (J.). **Physiological comparison of two strains of Penicillium.**—*Science*, N.S., cii, 2652, pp. 428–429, 1 fig., 1945.

A study of two commercially important strains of *Penicillium* [*R.A.M.*, xxv, p. 6] showed that one, *P.* sp. NRRL 1984-A yielded 40 to 50 units penicillin per ml. on a purely synthetic medium when growth factors were present as indole-acetic acid and/or naphthylene-acetic acid, adjuvants considerably enhancing penicillin production in such a synthetic medium, while the other, *P. chrysogenum* X1612, appeared to effect total synthesis of the penicillin molecule in reasonable amounts on a much less complex medium, though the provision of a suitable phenyl linkage was beneficial. With X1612 the addition of phenylacetic acid, 3·3 gm. per l., to the basal synthetic medium gave maximum yields of 225 units per ml.

In other tests the addition of sulphite waste liquor caused a decrease in penicillin yield with X1612 of 12 to 50 per cent., whereas the addition of sulphite waste improved yields with 1984-A in 19 out of the 36 cases by from 8 to 73 (mean 37) per cent.

FOSTER (J. W.), MCDANIEL (L. E.), WOODRUFF (H. B.), & STOKES (J. L.). **Microbiological aspects of penicillin. V. Conidiophore formation in submerged cultures of Penicillium notatum.**—*J. Bact.*, l, 3, pp. 365–368, 3 figs., 1945.

Abundant formation of conidia (roughly 400,000,000 per ml.) by about 14 strains of *Penicillium notatum* and one of *P. chrysogenum* [see preceding abstract] was obtained in four to six days at 20° to 30° C. in the following medium when aeration and agitation were effected by rotary shaking [*R.A.M.*, xxv, p. 6]: 20 gm. sucrose or brown sugar (grade soft No. 13), 6 gm. sodium nitrate, 1·5 gm. potassium phosphate, 0·5 gm. crystallized magnesium sulphate, and 25 gm. calcium chloride. The pigment secreted by the conidia imparted a greenish cast to the cultures.

WAKSMAN (S. A.) & REILLY (H. CHRISTINE). **Agar-streak method for assaying antibiotic substances.**—*Industr. Engng Chem., Analyt. Ed.*, xvii, 9, pp. 556–558, 1945.

Details are given of the agar-streak method for the assay of antibiotic substances, which is considered to offer sufficiently marked advantages over other procedures to justify its wider use, especially in screening tests with a large number of organisms and in the isolation of antibacterial agents from the crude medium. The antibiotic activities of actinomycin, chaetomin, clavacin, fumigacin, gliotoxin, streptomycin, and streptothricin are tabulated. In a study of the inactivation of antibiotic substances by cysteine the test organism was found to exert a decisive influence.

WOOSTER (RUTH C.) & CHELDELIN (V. H.). **Growth requirements of Penicillium digitatum.**—*Arch. Biochem., N.Y.*, viii, 2, pp. 311–319, 1 graph, 1945.

At $P_H 3$ (the approximate optimum for *Penicillium digitatum*), the maximum growth of an isolate of the mould from lemon fruit [*R.A.M.*, xx, p. 399] was obtained at the Oregon State College on a synthetic medium of which the only ingredient of unknown composition was vitamin-free hydrolysed casein. The carbohydrate requirements of the organism are adequately met by sucrose, glucose, fructose, or galactose, while the best nitrogen sources are asparagin and hydrolysed casein, especially in combination, peptone, aspartic acid, or ammonium salts supporting moderate growth. Of the various organic acids tested, only citric and malic permitted of appreciable development. *P. digitatum* requires the thiazole moiety of thiamin, quantitative growth curves for which may be obtained over the range of 0·01 to 3 γ per 25 ml. Pyridoxin, pantothenate, and biotin exert a stimulatory action, which in the case of the last-named is much more marked at and above P_H 6·5 (the second optimum for the mould) than at 3; in the presence

of 0·01 γ per 25 ml. the upper growth limit is extended by about one P_H unit. Growth within the same P_H range is further greatly activated by an unidentified factor in orange rind, which is soluble in water, methanol, 50 per cent. ethanol, and 50 per cent. acetone; insoluble in 95 per cent. ethanol, acetone, dioxane, ether, and pyridin; resistant to 11 hours' drying at 105° C., three hours' autoclaving at P_H 1 and 5, and to bromination, but destroyed by ashing, autoclaving at P_H 11, hydrogen peroxide in acid or alkali, and by nitrous acid; and removable by dialysis.

Borghetty (H. C.). **Mildewproofing of cellulose fibers.**—*Rayon Text. Mon.*, xxvi, 9, pp. 479–481, 1945.

A full account is given of the investigations and experiments carried out to satisfy the requirements of the United States Quartermaster Depot for suitable methods and products for the protection of fibres and fabrics from rot and mildew, on the basis of which the following were found to be appropriate for various purposes and under particular conditions: copapel A (cuprammonium carbonate) for permanency where 'feel' and colour are not important; puratized LN (2, 2-dihydroxy-5, 5-dichlorodiphenylmethane) [*R.A.M.*, xxiii, p. 71] and preventol GD (9-phenylmercuro-10-acetoxyoctadecanoic acid), semi-permanent types of mildew-repellents answering the majority of present Government specifications where 'feel' of fabric, colour, and toxicity requirements are important; puratized N 5-D (phenyl mercury oleate) [ibid., xxiv, p. 139], a semi-permanent product recommended for ease of application, especially with water-repellents; and puratized PC No. 1 (phenyl mercury acetate), semi-permanent, for use with alkali-soluble finishes, such as celfon.

Fargher (R. G.). **The incidence and control of mould and bacterial attack on textiles.**—*J. Soc. Dyers*, lxi, 5, pp. 118–122, 1945.

In this paper, read before the Midlands section of the Society of Dyers and Colorists at Nottingham University on 15th November, 1944, valuable information is presented on recent developments in the mildew- and rot-proofing of textiles [*R.A.M.*, xxiv, p. 427]. Cotton materials intended for use under humid conditions should be scoured with alkalis to remove various substances present in the raw cotton which contribute to the growth of micro-organisms. The following are the percentages of the inhibiting concentrations (preventing the growth in culture media for three weeks of the most common or resistant of 160 moulds isolated from mildewed cottons) of some newly discovered antiseptics in comparison with salicylanilide (shirlan) (0·01 to 0·02), para-nitrophenol (0·02), and zinc chloride (0·8), of which the two former are now extensively employed in England, while the last-named was in general use on fabrics designed for tropical climates before 1926; acetanilide 0·3, ortho-phenylphenol 0·02 to 0·03, trichlorophenol 0·005 to 0·01, pentachlorophenol 0·01 to 0·04, 2 : 3-dichloro- 1 : 4-naphthaquinone 0·04, 2 : 2′-dihydroxy- 5 : 5′-dichlorodiphenylmethane 0·08, mercaptobenzthiazole 0·02, zinc dimethyldithiocarbamate 0·16, para-acetoxymercuriacetanilide 0·005, and phenylmercuric acetate 0·02 to 0·04. Of these, mercaptobenzthiazole has shown considerable promise, especially in conjunction with salicylanilide. The joint use of two or more antiseptics, such as the foregoing or salicylanilide and para-nitrophenol, has been largely adopted of late to counteract the various drawbacks frequently arising from the application of one alone. The phenolic compounds are unduly volatile, while the mercurials lack stability in the presence of copper, iron, and zinc.

There are only two practicable methods of rot- (as distinct from mildew-) proofing, namely, copper and chromium treatments, a definite choice between which can only be made on the basis of experience of user-trials in the tropics. At the moment opinions differ widely as to the relative merits of the two processes. Roughly

speaking, the mineral khaki iron and chromium treatment is more effective against chemical attack by sun, air, and moisture, and copper compounds against microbiological infection. In either case, however, the efficacy of the method depends on the preliminary scouring of the material to reduce the incidence of mildew. Experiments have shown that copper may be lost through weathering more rapidly than has hitherto been supposed. Thus, after three months' exposure (5·38 in. rainfall), the percentages of copper hydroxide, copper carbonate, copper oleate, copper ricinoleate, copper naphthenate, cuprammonium, and chromium hydroxide in (*a*) 22-oz. cotton canvas, and (*b*) 9-oz. sheeting were 21, 14, 42, 71, 75, 14, and 94, and 3, 4, 30, 55, 38, 4, and 92, respectively. The persistence of copper is not appreciably improved by the application of waterproofing emulsions, but coating the fabric with wax, as in the cuprammonium-bitumen process, has shown some promise in this respect. The very much poorer persistence of copper as compared with chromium is associated with the readier solubility of the former in dilute solutions of weak organic acids. The high resistance to microbiological growth, in the absence of impurities, of chrome-proofed cotton resembles that observed with cellulose acetate, and may be due in part to a related cause, viz., a strong affinity between cellulose and hydrous chromic oxide. Some increase in the resistance of copper to leaching has been obtained by its application to previously mineral khaki-dyed or chrome-proofed materials; the comparable effect resulting from the use of the naphthenate is open to objections on the grounds of odour and greasiness.

The use of copper or chromium is contra-indicated in the case of fabrics to which drying oils may be applied, while the former may be detrimental to cotton or flax intended for rubber-proofing and to yarns or fabrics dyed dark green with sulphur.

Golding (N. S.). **The gas requirements of molds. IV. A preliminary interpretation of the growth rates of four common mold cultures on the basis of absorbed gases.**—*J. Dairy Sci.*, xxviii, 10, pp. 737–750, 12 graphs, 1945.

The growth of four common moulds of dairy products, *Aspergillus niger*, *Penicillium expansum*, *Aspergillus flavus*, and *Oospora lactis* [*R.A.M.*, xxiv, p. 426], on malt agar in various gas mixtures at different temperatures and pressures was shown to be influenced by the gas laws as they govern the solubility of the gases in the medium or mycelium. The inhibitory effect of carbon dioxide on the development of the moulds is in proportion to its solubility and not to the composition of the gas above the medium or mycelium.

Harris (G. C. M.). **Food yeast. The mycologist's contribution to post-war nutrition.**—*Int. Indust.*, N.S., xxv, 12, pp. 416–420, 1 fig., 1944.

A brief survey of the nutritional properties of food yeast is followed by an account of the industrial development by Colonial Food Yeast Ltd. in Jamaica for post-war needs of *Torulopsis utilis* var. *major*, an abundant and palatable source of protein and vitamin B [*R.A.M.*, xxiii, p. 399].

Sartory (A.), Sartory (R.), & Wurtz (B.). **(1) Contribution a l'étude de l'action du radium sur les champignons inférieurs. Les effets des radiations γ sur Sterigmatocystis nigra. (2) Influence des émanations du radium sur le Sterigmatocystis nigra.** [(1) Contribution to the study of the action of radium on the lower fungi. The effects of γ radiations on *Sterigmatocystis nigra*. (2) The influence of radium emanations on *Sterigmatocystis nigra*.]—*C.R. Acad. Sci., Paris*, ccxviii, 6, pp. 247–249; 8, pp. 328–329, 1944.

After 48 hours' exposure to 7·2 millicuries of radium, a culture of *Sterigmatocystis nigra* [*Aspergillus niger*] on a medium consisting of Czapek's solution 10 c.c., ammonium sulphate 0·5 gm., and distilled water to make up to 100 c.c. was

observed to comprise hyphae up to six times the normal dimensions, frequently terminating in ampullae discharging trails of protoplasm, abortive phialides and sterigmata, and various types of resting organs. Under a dosage of 14·4 mc., the protoplasm breaks up into well-defined, circular elements, 2 to 4 μ in diameter, simulating endospores, while in the hard parts of the mycelium, dark-coloured, bushy masses develop, consisting of interwoven, intricate hyphae and presenting the aspect of perithecia. A dosage of 21·6 mc. induces the formation, besides the foregoing growth types, of numerous highly-coloured, cylindrical, spinous bodies, extruding circular cells with a well-defined membrane and granular protoplasm, often in groups of four, sometimes five or six, occasionally singly, presumably representing asci and ascospores.

In the second paper further details are given of the development of perithecia, asci, and ascospores by *A. niger* under the influence of indirect irradiation.

FRIES (N.). **Über Röntgen-induzierte physiologische Mutationen bei Ophiostoma multiannulatum (Hedgc. et Davids.). Vorlaüfige Mitteilung.** [On Röntgen-induced physiological mutations in *Ophiostoma multiannulatum* (Hedgc. & Davids.).]—*Ark. Bot.*, xxxii, 2, No. 8, 9 pp. 1945.

The physiological properties of six monospore mycelial mutants isolated from a nutrient agar culture of *Ophiostoma multiannulatum* [*Ceratostomella multiannulata*: *R.A.M.*, xix, p. 315] by 100 minutes X-ray irradiation were investigated. No. 225 was heterotrophic for biotin, 358 and 446 were both parathiotrophic, the former also reducing sulphite, which the latter was unable to do; in the case of 460 the essential growth factor was not identified; 513 appeared to require adenin; and 617 was heterotrophic for para-aminobenzoic acid. All the constitutional changes in the mutants were shown to be hereditary except for the capacity of No. 358 for the reduction of quadrivalent sulphur, which did not descend to the next generation.

PAYETTE (A.). **Hétérotrophie envers la thiamine de quelques champignons phytopathogènes.** [Heterotrophy in respect of thiamin of some phytopathogenic fungi.]—*Ann. Ass. canad.-franç. Sci.*, xi, p. 90, 1945.

In a mineral-dextrose medium containing some organic acids, glycine, and asparagin, *Phytophthora infestans* required a supplementary dose of vitamin B for its development; *Septoria avenae* and *S. pisi* could dispense with one or the other constituent of thiamin (pyrimidin or thiazole); *Stereum purpureum* derived noticeable benefit from the addition to the substratum of pyrimidin or thiazole and still more from a mixture of the two components or of the complete molecule; and *Schizophyllum radiatum* was capable of slight growth in the presence of either pyrimidin or thiazole, but developed much more freely with added thiamin and best of all with a mixture of the two components.

NEUWEILER (E.). **Kartoffelanbauversuche der Vereinigung schweizerischer Versuchs- und Vermittlungsstellen für Saatkartoffeln, durchgeführt von schweizerischen landwirtschaftlichen Schulen, von Mitgliedern der Vereinigung, von Saatgutgenossenschaften und landwirtschaftlichen Betrieben.** [Potato-cultivation experiments of the Union of Swiss Experiment Stations and Agencies for Seed Potatoes, carried out by Swiss agricultural schools and members of the Union, of co-operative societies for seed production, and of agricultural concerns.]—*Annu. agric. Suisse,* xlv, 9, pp. 865–889, 1944. [French summary.]

The following items of phytopathological interest occur in this report of potato-cultivation experiments in Switzerland from 1938 to 1943. In the main series of trials (1938 to 1940) on table potatoes, the percentages of severe virus infection (average for 17 varieties) in 1938, 1939, and 1940 were 7·9, 29, and 51, respectively. The most resistant was the medium-early Flora, which showed only 9 per cent.

severe infection in 1940, followed by Edelgard (late) with 17 per cent., while the minimum for the rest of the varieties was 30 per cent., the late Industrie, Gloria, Kapro, and Prisca, for instance, being attacked to the extent of 71, 90, 94, and 76 per cent., respectively. Brief descriptions are given of each of the test varieties, with notes on their reactions to virus diseases and late blight [*Phytophthora infestans*: cf. *R.A.M.*, xxv, p.]. Besides those already mentioned the early Frühmölle and the medium-early Frühbote and Sieglinde are fairly resistant to virus infection but very susceptible to late blight. Apulia (medium-early) is slightly to moderately susceptible to degeneration (of virus origin) and *P. infestans*, Record semi-resistant to both diseases, Centa (late) susceptible to virus infections and fairly so to late blight, and Katahdin resistant to mild mosaic [potato virus X] but rather susceptible to the severe form [potato virus Y] and *P. infestans*. All the varieties except Industrie are immune from wart disease [*Synchytrium endobioticum*].

Virus diseases were also largely responsible for the deterioration of the six fodder varieties under observation during the period under review, and in fact necessitated the discontinuance of three, viz., Spätrot, Schlesien, and Robinia. The average percentage of infection in 1940 for the three remaining varieties, Sickingen, Rubingold, and Herulia, was 20, the first-named showing the largest increase compared with 1938 (from 3·3 to 31 per cent.). Rubingold and Sickingen are susceptible to late blight, the other fodder varieties less so. Prisca, which may be grown either for the table or as fodder, is fairly susceptible to virus diseases and resistant to *P. infestans*.

In a series of trials (1940 to 1942) on 14 imported culinary varieties the average severe virus infection rose from 3·5 per cent. in the first year to over 64 in the third. The medium-early Flava, already tested in the foregoing series but included here as a standard, gave the best performance, with 10 per cent. severe infection in the third year compared, for instance, with 100, 95, 88, and 82 per cent. in The Alness (British early), Taara (Estonian medium-late), Kratt (Estonian late), and Draga (German early), respectively; only three varieties besides Flava showed under 50 per cent. disease, i.e., Oberarnbacher Frühe (German medium-early), Celerina III (German medium-late), and Arran Banner (British medium-early) with 39, 45, and 47 per cent., respectively.

Supplementary experiments were carried out in mountainous districts in 1939–40 (Elm, canton of Glarus) and 1941–43 (Lower Engadine). Under these favourable conditions for the crop the average incidence of severe virus infections in the five varieties comprised in the former test increased only from 1·1 to 2·5 per cent., Voran (late) being the most resistant with 0·5 per cent.; in the latter test the average for ten varieties in 1943 was 3·8 per cent. as against 1·8 in 1941.

LARSON (S. G.). **Bladlusene og deres Betydning som Virusspredere paa Beder og Kartofler.** [Aphids and their importance as virus disseminators on Beets and Potatoes.]—*Tidsskr. Planteavl*, xlv, 1, pp. 97–139, 1940. [Received January, 1946.]

Following a summary of the available information concerning the life-history and biology of aphids and the nature of viruses, the writer gives an account of the functions of the former as vectors of certain beet and potato viruses in Denmark. The sugar beet mosaic virus [*R.A.M.*, xxii, p. 124] is spread mainly by *Aphis fabae*, the other aphid pest of beets, *Myzus persicae*, though technically capable of transmitting the inoculum, being of little or no practical importance in the spread of the disease. It may be safely accepted that the infective material assimilated by one generation of aphids is not transmissible to the next, and that consequently all individuals overwintering in the egg stage on various shrubs, such as *Euonymus europaeus* and *Viburnum opulus*, are virus-free. The same will also naturally apply to the spring migrants since the winter hosts do not harbour the virus. Further-

more, the disease not being transmissible through the seed or soil, young beets are presumably also healthy until they are infected by winged aphids after feeding on the seed-bearer beets, but once the disease is acquired by the young plants they develop mosaic symptoms and harbour the virus until the following year. It is possible that the aphids may also overwinter on diseased beets in clamps, which would provide another source of spring inoculum. Mechanical transmission of the virus is of negligible importance, and even aphid activities in this direction are largely confined to seed-producing areas; arising from these observations, an obvious control measure consists in the separation of the new crop from the seed-bearers and laying out the fields in such a way that the prevailing wind does not pass from the old to the young plants.

In the case of beet yellows virus [ibid., xxiv, p. 485] the roles of the two aphids under discussion are reversed, *M. persicae* alone being concerned to any appreciable extent in its transmission. Unlike the sugar beet mosaic virus, that of sugar beet yellows is distributed at random over the field, the viruliferous wingless nomads produced by the spring migrants on any one part passing rapidly from leaf to leaf of the beets in the immediate vicinity. Very few winged individuals develop during the summer, so that new foci of infection are unlikely to be found later than July. In contrast to *A. fabae*, the stationary colonies of which are clearly visible and amenable to control by nicotine sprays, the visits of *M. persicae* are of brief duration, and moreover, the aphids are so well concealed on the under side of the leaves as to escape the farmer's observation. The sugar beet yellows virus overwinters principally on cultivated beets in clamps, and hence the control of the disease should be based on the selection of sound plants for next year's seed; their storage in separate clamps, which should be cleansed in the spring, primarily of germinating beets but also, where infection has been severe, of orache [*Atriplex*] and goosefoot [*Chenopodium*]; and precautions against contamination by overwintered spinach or diseased greenhouse plants of the Chenopodiaceae [ibid., xvii, p. 338].

Of the many viruses attacking potatoes the potato leaf roll virus is one of the most serious [ibid., xxiv, p. 402]. It overwinters exclusively in infected tubers, and the spring migrants of the aphid vector, *M. persicae*, are virus-free, unless they happen to have hibernated on diseased tubers in the cellar or clamp. Thus, in fields consisting entirely of healthy plants, the sucking of the aphids will cause no injury, but where a few infected individuals are present heavy losses may be expected in the course of the summer, not only from the visits of the spring migrants themselves, but also, at a later date, from those of the succeeding generation of wingless nomads; the full extent of such secondary attacks can only be gauged in the following season, since the symptoms they induce on the host at this late stage are indeterminate. The importance of the use of healthy seed stocks will be apparent from the foregoing observations. They are procurable in Denmark from so-called 'sanatorium districts' the exact limits of which have not yet been defined, where few or no aphids are present. By this means leaf roll can be virtually eliminated from a given potato variety within a few years without risk of an early recurrence.

Van der Plank (J. E.). **Suitability of a cool maritime climate for seed Potato production.**—*Nature, Lond.*, cliv, 3916, pp. 644–645, 1944.

The author describes simple equipment, comprising only a maximum and minimum thermometer and a Stevenson screen, for use in a test to decide the most suitable localities for seed-potato production in a cool, maritime climate in South Africa. The criteria adopted were a mean maximum temperature about 65° F. or less, and a daily range of 13° or less, during June. While averages over many years are ultimately concerned, substantial accuracy may be possible in a single season by determining from existing records the necessary correction for seasonal

abnormality. Such records indicate land worth surveying. In the case of South Africa a really suitable maritime climate for this purpose was found in the course of the survey to be limited to a narrow, barren strip along the west coast. In such climates it is considered that aphid surveys should be continued over many years if they are to be sound, and that a June temperature test has advantages not only in respect of speed, but because it is unaffected by the often remediable proximity of *Brassicae* or other winter hosts, and because, being a test of the climatic conditions governing the flight of *Myzus persicae*, it measures the tendency towards migration, a finer test of fitness than the total number of aphids present. In the maritime type of seed area cool, moist sea winds are desirable and their prevalence can be recognized simply by the intensity of the maritime influence on climate, as determined by the June temperature test. Mere bleakness and high altitude are no adequate substitutes for exposure to the sea. In a hot, dry climate [*R.A.M.*, xxiii, p. 312] a mean maximum during the summer of about 90°, a daily range of 28° to 35° or more, and strong, hot, dry land winds are the desirable features for the production of good seed.

HELLBO (E.). **Den förenklade fältkontrollen med Utsädespotatis under år 1944.** [The simplified field inspection of seed Potatoes during the year 1944.]—*Landtmannen, Uppsala*, xxix, 2, pp. 31–32, 1945.

Of 813 potato fields inspected for certification in Sweden during 1944 (42 per cent. more than in 1943), 625 (76·9 per cent.) were passed, while 8·5, 11·7, and 2·9 per cent. of the failures were rejected on account, respectively, of varietal impurities, severe disease, and a combination of the two latter factors. The province of Halland submitted an area of 127·7 ha. for inspection, of which 52·3 ha. (41 per cent.) was rejected, an indication of the widespread distribution of virus diseases in this region [*R.A.M.*, xxv, p. 77]. Of the total number of fields examined, 36 (4·4 per cent.) contained more than 10 per cent., and 62 (7·6) between 5 and 10 per cent. virus disease, the maximum permitted incidence being 5 per cent.

BJÖRLING (K.). **Fältförsök med Potatiskräfta år 1944.** [Field experiments with Potato wart in the year 1944.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1944*, 6, pp. 81–84, 1 fig., 2 diags., 1944.

Of 15 new potato selections tested for their reaction to wart disease [*Synchytrium endobioticum*] in 1944 in an infested field in Scania, Sweden [*R.A.M.*, xxv, p. 78], 14 had proved immune in preliminary laboratory tests and one slightly susceptible. In the field trials 13 of the 14 remained immune, one was as heavily infected as the susceptible Prof. Wohltmann, used as a control, while the slightly susceptible selection continued to react in the same way. It is evident from these results that laboratory tests afford a reasonably reliable indication of varietal response to wart disease, but that they require to be confirmed by further experiments in the field before release for the market as definitely immune can be sanctioned.

HOLMBERG (C.). **Hur länge kan Potatiskräftans smittämne kvarleva i jorden?** [How long can the inoculum of Potato wart persist in the soil?]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1944*, 6, pp. 84–86, 1944.

In the autumn of 1928 renewed outbreaks of potato wart [*Synchytrium endobioticum*] after a period of quiescence were reported from a number of districts in south and central Sweden [*R.A.M.*, viii, p. 123 and preceding abstract], and in 1944 experiments were conducted on 16 sites, 13 infected in 1928 and 3 in 1929, to determine the duration of persistence of the pathogen in the soil. In some of the test areas wart-immune potatoes had formed part of the rotation since the

recurrence of the epidemic, while others had been allowed to revert to grass. The fungus was found to have disappeared completely from the cultivated soils, whereas in those used for pasturage, hay, and the like, it was still actively pathogenic to the susceptible Up-to-Date.

HOLMBERG (C.). **Potatiskräfta och Potatisål i Sverige år 1944.** [Potato wart and Potato eelworm in Sweden in the year 1944.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1945*, 1, pp. 12–13, 1945.

During 1944 potato wart [*Synchytrium endobioticum*] was reported from 76 allotments distributed over 29 parishes in 12 provinces of Sweden [see preceding abstracts], 15 of the new foci originating in eight localities hitherto free from infection.

JAARSVELD (ALIDA). **De invloed van verschillende bodenschimmels op de virulentie van Rhizoctonia solani Kühn.** [The influence of various soil fungi on the virulence of *Rhizoctonia solani* Kühn.]—Thesis, Univ. Amsterdam, 101 pp., 5 pl., 2 figs., 15 graphs, 1940. [Received November, 1945.]

This is the original version of the author's studies on the antagonism of various soil fungi to *Rhizoctonia* [*Corticium*] *solani*, as expressed in the reduction of its pathogenicity to Chinese cabbage seedlings, the salient features of which have already been noticed from another source [*R.A.M.*, xxii, p. 494].

VANDERWALLE (R.) & ROLAND (G.). **Contribution à l'étude du mildiou de la Pomme de terre.** [A contribution to the study of Potato 'mildew'.]—*Parasitica*, i, 2, pp. 41–57, 1 pl., 1945. [Flemish summary.]

In a study of potato 'mildew' [blight: *Phytophthora infestans*] carried out at Gembloux, Belgium, in 1942, the main points investigated were varietal susceptibility, the influence of cultural factors on severity of attack, and the relation between the microclimate of the host and the disease.

Experimental infections showed that the foliage of the extensively cultivated Bintje variety is much more susceptible to *P. infestans* than that of Robusta and Erika, though these became severely infected under certain circumstances. Foliage grafts between varieties of different degrees of susceptibility did not affect their susceptibility. When cut halves of tubers were inoculated under moist conditions with *P. infestans*, the Robusta variety was the least susceptible to rot (associated also with *Fusarium* sp., *Penicillium glaucum*, and bacteria), Erika intermediate, while Bintje was most susceptible. Field observations on 12 varieties showed that Prisca was the least susceptible to foliage infection by *P. infestans* and Belle de Fontenay and Alberta to tuber rot.

Fertilizer treatment, planting space, and seed-tuber weight appeared to have no effect on intensity of foliage attack. When Bintje tubers were planted on 9th April, 11th May, and 19th June, *P. infestans* appeared at the end of July in the plots planted on the two earlier dates; on 4th August infection was very severe on these plants, while the plot planted on 19th June was only lightly attacked. By 26th August, however, the foliage in all three plots was completely destroyed.

Evidence was obtained that the temperature of potato plants was slightly lowered both by nitrogenous manuring and closer spacing.

DE BRUYN (HELENA L. G.). **Methode voor het vaststellen van de vatbaarheidsgraad van Aardappelknollen voor de Aardappelziekte.** [Method for the determination of the degree of susceptibility of Potato tubers to late blight.]—*Tijdschr. PlZiekt.*, xlix, 5–6, pp. 77–99, 1943. [English summary. Received November, 1945.]

The following method was devised at the Mycological Laboratory, Wageningen,

Holland, for the determination of susceptibility to late blight (*Phytophthora infestans*) in potato tubers [*R.A.M.*, iv, p. 761; vi, p. 47; xi, p. 71; xix, p. 490, *et passim*]. Tubers wounded with a cork borer are inoculated with a zoospore suspension, cut in two after five days, the cylindrical piece enclosed by the wound being removed, and the two halves placed in a humid atmosphere in the dark. Observations are made every three days for a fortnight, at which juncture tubers showing necrosis but no mycelium are considered to be diseased. The temperature of 10° C. at which the tubers are kept, being unfavourable to the development of *P. infestans*, accentuates intervarietal differences.

The experiments under discussion covered the winters of 1940–1 and 1941–2 and involved 22 varieties; the inoculations were performed with two isolates of the fungus, half through the navel and half through the seed end. Three types of resultant necrosis were differentiated, namely, I, in which the initial symptom is a sharply defined necrosis, followed by mycelial production: this was the most prevalent form of infection, occurring in Alpha, Eersteling [Duke of York], Eigenheimer, Evergood, Frühmölle, Hellena, Katahdin, Thorbecke, Triumph, Voran, Westeinder Blauwe, and Zeeuwsche Blaue; II, an ill-defined necrosis develops simultaneously with the mycelium, as in Bevelander, Bintje, and Bravo; and III, characterized by the production of the mycelium and fructifications before the necrosis, observed in Furore, Industrie, Matador, Noordeling, Populair, Record, and Roode Star. In general, the navel end proved to be the more susceptible of the two extremities, the varieties in which the differences were least noticeable falling in type III.

The disparities in virulence between the two isolates suggest that they belong to different physiologic races of *P. infestans* [ibid., xvii, p. 765; xxiii, p. 147, *et passim*], but in the absence of a test assortment of varieties this point could not be definitely decided. The average percentages of successful inoculations secured with isolates I and II over the two-year period on roughly 2,000 tubers of Eigenheimer, 1,000 of Alpha (the two controls), and 400 of each of the other 20 were 90 and 82, respectively. The least susceptible varieties were Hellena (with 55 per cent. diseased tubers), Bravo (68 per cent.), Matador (76 per cent.), and Voran (77 per cent.).

Several workers on late blight have reported modifications in pathogenicity caused by the influence of the last host [ibid., xiv, p. 391; xvi, p. 53; xvii, p. 482], and similar observations were made in the course of the studies herein described. In 1942–3 an experiment was instituted to obtain further information on this question. The fungus was cultured on four varieties, Alpha, Duke of York, Eigenheimer, and Bravo, and cross-inoculations carried out on 20 tubers of each. The numbers of the four mean periods required for the development of mycelium from the zoospores of sporangia grown on each of the four varieties were added together, and the ratio computed between the times necessary for the production of infection by the zoospores of a given variety and those of Alpha. A third monospore isolate of the fungus, Z, was included in the test, which comprised 12 varieties. There were considerable differences between the varieties in the ratio of the period elapsing from inoculation to mycelial production, ranging for isolate I from 0·73 (Industrie) to 1·08 (Eigenheimer), for II from 0·83 (Bintje) to 1·25 (Evergood), and for Z from 0·56 (Record) to 1·09 (Voran). No correlation was established between the degree of susceptibility of a given variety and the pathogenicity of the fungus, after growth thereon, to a new host.

The experimental data are considered to show that a method for the determination of the reaction of potato tubers to *P. infestans* is practicable, provided the following conditions are observed: (1) the use of zoospores for inoculation, (2) growth of material for inoculum on special varieties, and (3) maintenance of the infected tubers at 10° C.

CUNNINGHAM (H. S.) & REINKING (O. A.). **Fusarium seed-piece decay of Potatoes on Long Island.**—*Fm Res.*, xi, 3, pp. 8–9, 2 figs., 1945. [Abs. in *Exp. Sta. Rec.*, xciii, 5, p. 592, 1945.]

Preliminary tests indicated that potato seed-piece decay caused by *Fusarium* spp. [*R.A.M.*, xxiv, p. 267] is controllable by seed treatment. The fungus most frequently obtained from dry-rot tubers was *F. caeruleum* [ibid., xxiv, pp. 201, 245], but *F. solani* [var.] *striatum* [cf. ibid., xiv, p. 613] and *F. sambucinum* f. 6 [cf. ibid., xxiv, p. 384] were also isolated.

SETH (L. N.). **Studies on the false-smut disease of Paddy caused by Ustilaginoidea virens (Cke.) Tak.**—*Indian J. agric. Sci.*, xv, 1, pp. 53–55, 1945.

False smut of rice (*Ustilaginoidea virens*) [*R.A.M.*, viii, p. 716; xvi, p. 231], ordinarily of minor importance in Burma, appeared in epidemic form in 1935 at Hmawbi and the surrounding areas. In 1936 the disease reappeared in a milder form and from 1937 to 1941 caused no anxiety. At Hmawbi the Agricultural Farm was the chief centre of infection when some plots showed all the plants diseased and about 6 per cent. of the grains infested. In germination tests spores from fresh sclerotial bodies showed after 24 hours about 10 per cent. germination, each spore producing a short, unbranched germ-tube. After another 48 hours the germ-tubes were found profusely branched and septate, bearing clusters of small pear-shaped, hyaline conidia formed both terminally and laterally at the hyphal tips. Transfers of the branched germ-tubes and secondary conidia to a Quaker oats medium developed a white, fluffy, felt-like mycelium which after three weeks produced many white, compact, almost round sclerotial bodies. These turned orange-yellow and finally olive-green, becoming slightly powdery in appearance and corresponding closely with those on the host plant.

On plain agar the secondary conidia germinated similarly to the parent spore. They became slightly swollen at first, and then produced branched and septate germ-tubes bearing clusters of small, piriform, hyaline conidia at the tips. Compared with the parent spores these tertiary conidia were slightly smaller and their germ-tubes narrower and sparsely septate. On transference to Quaker oats agar, the usual sclerotial bodies were obtained from these germ-hyphae and tertiary conidia.

Sclerotia were obtained repeatedly in the laboratory in cultures made during November to February, but none formed in cultures made from March to August, when the growth of the mycelium also was not typical, being mainly flat and devoid of aerial hyphae. The fungus failed to grow at 34° C. and prolonged incubation at this temperature was lethal. The optimum temperature appears to be in the neighbourhood of 26°. Viability of the spores does not exceed eight months. Inoculation of flowers and of grains in the milk stage failed to produce infection and seed dusted with spores produced healthy plants.

SCHNEIDER (H.). **Surveys and observations on Verticillium wilt of Guayule in California from 1943 to 1945.**—*Plant Dis. Reptr*, xxix, 22, pp. 615–617, 1945. [Mimeographed.]

The final report of investigations from 1943 to 1945 into infestation with *Verticillium* wilt of fields planted with guayule [*Parthenium argentatum*: *R.A.M.*, xxiv, p. 284] by the United States Emergency Rubber Project in Kern County, California, shows that plants grown in infested fields, which escape infection during the first spring, are susceptible to it in the course of the following autumn, winter, or spring. Some of the severely affected plants may partly recover under the high summer temperatures of Kern County but remain much smaller than healthy plants. Most moderately infected plants, while showing external signs of recovery, remain stunted, and the rubber yield on a 40-acre field was reduced by about,

25 per cent. The rubber content was not lowered, but the dry weight was considerably reduced.

SHIVE (J. W.). **Boron in plant life—a brief historical survey.**—*Soil Sci.*, lx, 1, pp. 41–51, 1945.

The role of boron in plant economy is reviewed in the light of contemporary studies under the headings of discovery and distribution of boron in plants and soils, boron as a toxic and as a stimulating agent, indispensability of boron for plants, nature of boron-deficiency effects, and relation of boron to other elements in nutrition of plants. The bibliography comprises 46 titles.

McCALLA (T. M.). **Microbiological studies of the effect of straw used as a mulch.**—*Trans. Kans. Acad. Sci.*, xlvi, pp. 52–56, 2 graphs, 1943. [Received November, 1945.]

Observations and tests at the Nebraska Agricultural Experiment Station indicate, *inter alia*, that during damp weather the top layer of soil mulched with plant residues has a much larger population of fungi and other micro-organisms than ploughed land without such material. Immediately after straw residues are ploughed under, there is a larger increase in the number of bacteria and fungi than in comparable soil mulched with straw. After six months, roughly one-third of two-ton applications of maize stalks had rotted, the corresponding figures for two-, four-, and eight-ton treatments with wheat straw being two-thirds, one-half, and one-third, respectively.

EISENBERG (W. V.). **An unusual distribution of a rust: an aecidium on Lippia berlandieri.**—*Plant Dis. Reptr*, xxix, 22, pp. 618–620, 1945. [Mimeographed.]

The aecidial stage of a rust found on the lower surface of leaves of oregano (*Lippia berlandieri*), an aromatic shrub used for seasoning food, from Mexico, was identified by the author as *Aecidium evansii* P. Henn., reported by T. B. R. Evans from the Transvaal in 1908 (*Englers bot. Jb.*, xli, pp. 270–273). The identification was confirmed by Dr. G. B. Cummins.

KEYWORTH (W. G.). **Hop diseases.**—*Rep. E. Malling Res. Sta., 1944*, pp. 31–32, 1945.

During 1944 three outbreaks of *Verticillium* wilt of hops (*V. albo-atrum*) [*R.A.M.*, xxiv, p. 165] were newly reported to East Malling. One was a progressive outbreak of at least three years' standing. In addition, eight previously known outbreaks were notified during the Ministry of Agriculture inspections for the certification of wilt-free gardens. Of these, four were in Kent, and four in the West Midland area; none appeared to be of the progressive type. In pathogenicity studies by I. Isaac, comparative soil infections of field plots with diseased bines from progressive and fluctuating outbreaks, respectively [cf. ibid., xviii, p. 709], yielded differences in wilt incidence, but parallel stem inoculations showed no difference in pathogenicity. When this soil-inoculation experiment was repeated on two contrasted soil types, the average wilt severity on one differed widely from that on the other. When a similar test was carried out in tubs, marked differences in incidence were observed as between the two soils.

All the isolates of *Phytophthora cactorum* [ibid., xxii, p. 406] obtained from hops in widely separated localities appeared to be morphologically identical; the fungus is, probably, a common soil inhabitant of hop gardens.

An abnormal form of hop canker, apparently due to a *Fusarium*, affected the bines at 6 to 18 in. above soil-level in numerous localities.

KEYWORTH (W. G.). **Three important Hop diseases.**—*Rep. E. Malling Res. Sta. 1944*, pp. 130–134, 3 figs., 1 map, 1945.

This paper on the hop diseases *Verticillium* wilt [*V. albo-atrum*], nettlehead, and mosaic is a reprint of one already noticed from another source [*R.A.M.*, xxiv, p. 287].

SHEPHARD (C. Y.). **The Sugar industry of Fiji.**—60 pp., 6 maps, London, H.M. Stationery Office, 1945. 1*s*.

Only three sugar-cane diseases are at present considered to be of potential importance in Fiji, according to a statement on p. 15 of this report. Fiji disease has been effectively combated by reducing the number of ratoons to one, planting a green-manure crop between periods of cane cultivation, regular inspections of young cane for the purpose of roguing, selection of sound planting material, and use of resistant varieties. Leaf scald (*Bacterium* [*Xanthomonas*] *albilineans*) and downy mildew (*Sclerospora sacchari*) have also been held in check by the measures adopted by the Colonial Sugar Refining Company.

DUNCKELMAN (P. H.) & EDGERTON (C. W.). **Report on cooperative tests with the hot water treatment of Sugarcane.**—*Sug. Bull., N.O.*, xxiii, 18, pp. 138–141, 1945. [Abs. in *Exp. Sta. Rec.*, xciii, 5, p. 593, 1945.]

In further work on the hot-water treatment of seed sugar-cane [? against *Physalospora tucumanensis*: cf. *R.A.M.*, xxiii, p. 359] the results obtained [which are tabulated] confirmed those of previous years, treatment at 52° C. for 20 minutes again giving increased yields.

BLUMER (S.). **Parasitische Pilze aus dem Alpengarten Schynige Platte.** [Parasitic fungi from the Alpine garden Schynige Platte.]—*Mitt. naturf. Ges. Bern*, N.F., i, pp. 39–53, 1 fig., 1944.

Since 1932 the writer has paid one or two annual visits to the Schynige Platte Alpine garden, which was laid out in 1929, and at the time of writing 67 indigenous parasitic fungi had been identified on 65 hosts, of special interest being *Entyloma ranunculi* on *Delphinium elatum* and *Ustilago violacea* on *Gypsophila repens*.

VIÉGAS (A. P.). **Alguns fungos do Brasil. IV. Uredinales.** [Some fungi of Brazil. IV. Uredinales.]—*Bragantia, S. Paulo*, v, 1, pp. 1–144, 48 pl., 89 figs., 1945.

Included in this critically annotated list, accompanied by numerous excellent illustrations, of Brazilian rusts [cf. *R.A.M.*, xxiv, p. 207] are *Coleosporium ipomoeae* on sweet potato [ibid., xxiii, p. 245] in São Paulo; *Phakopsora crotalariae* on *Crotalaria anagyroides* in São Paulo; *Puccinia menthae* on *Mentha arvensis* in São Paulo [ibid., xxiii, p. 189]; *P. psidii* [ibid., xxiv, p. 353] on guava in São Paulo and Parahyba, *Eugenia jambos* in São Paulo and Rio de Janeiro, *E. uvalha*, *Myrciaria jaboticaba*, and *Marlierea edulis* in São Paulo, and *Callistemon speciosus* in Minas Gerais; *P. purpurea* on sorghum in São Paulo and Sergipe and on *Sorghum halepense* in São Paulo and Parahyba; *Ravenelia indigoferae* on *Indigofera anil* [cf. ibid., xv, p. 703] in São Paulo; and *Uromyces manihotis* on cassava in Rio de Janeiro and São Paulo [ibid., xvii, p. 17].

THOM (C.) & RAPER (K. B.). **A manual of the Aspergilli.**—ix+373 pp., 7 col. pl., 76 figs., London, Bailliere, Tindall & Cox, 1945. £1. 18*s*. 6*d*.

This valuable book is designed as an aid to the identification of the members of the genus *Aspergillus*; as the authors point out, it is not a monograph, and is an entirely new work, not a new edition of the well-known 'The Aspergilli' of Thom and Church [*R.A.M.*, v, p. 700]. The first six chapters comprise a general discussion of the history, classification, morphology, laboratory treatment, and variation

of the genus. Of the following 15 chapters the first explains the use of the manual, with keys based on colour and morphology, and the others are each devoted to one of the main groups into which the genus is subdivided. The final four chapters provide topical and general bibliographies, a full check list of species, and a list of the species and varieties accepted by the authors. This last list comprises 77 species, eight varieties, and four mutants [the sub-specific rank 'mut.' is adopted, though this is not provided for by the International Rules of Nomenclature].

The descriptions given are based on the authors' observations of large numbers of isolations, including type cultures whenever this has been possible; a few species known only from type material and literature are, however, accepted. One new variety is recorded: *A. terreus* var. *aureus*, from soil, Texas [without a Latin diagnosis]; changes in nomenclature include *A. butyracea* n. comb. (syn. *Sterigmatocystis butyracea* Bain), *A. foetidus* nom. nov. [as n. sp.] (syn. *A. aureus* Nak.), *A. fonsecaeus* nom. nov. [as n. sp.] (syn. *S. fusca* Bain.), *A. mangini* nom. nov. [as n. comb.] (syn. *A. minor* (Mang.) Thom & Church), and *A. terreus* var. *boedijni* n. comb. (syn. *A. boedijni* Blochw.).

Of the numerous illustrations the most useful are the relatively few line drawings. The colouring shown in the photographs of plate cultures does not always conform fully with descriptions in the text.

Fisher (Eileen E.). **Notes on two Australian fungi of the 'sooty mould' group.**—*Proc. roy. Soc. Vict.*, N.S., liv, 1, pp. 1–4, 1 pl., 1942. [Received December, 1945.]

In this paper, read on 3rd April, 1941, notes are given on two Australian sooty moulds, *Limacinia phloiophilia* n. sp. and *Hysterostomella filicina*. The former was found on *Kunzea peduncularis* in Victoria and *Leptospermum lanigerum* var. *montanum* in Tasmania and the latter occurred as a parasite on *Dicksonia antarctica* near Melbourne.

Heggestad (H. E.). **Varietal variation and inheritance studies on natural water-soaking in Tobacco.**—*Phytopathology*, xxxv, 10, pp. 755–770, 3 figs., 1945.

The inheritance of the natural water-soaking character in tobacco was studied at the Wisconsin Agricultural Experiment Station in crosses involving seven varieties of varying reactions. The F_1 progeny were mostly intermediate in respect of the condition between the susceptible and resistant parents, but in crosses between Samsun (intermediate) and Daruma (very resistant) and Havana 211 (intermediate) and Havana 142 (resistant), no water-soaking developed in two trials on the offspring, suggesting partial dominance of the resistant character. The responses of the F_2 and F_3 families clearly indicated the segregation of many genetic factors controlling the inheritance of water-soaking. F_3 families approximating in resistance to the most resistant parent were obtained. In inoculation experiments with the wildfire organism (*Phytomonas tabaci*) [*Pseudomonas tabacum*] on 15 tobacco varieties under conditions favourable to natural water-soaking [*R.A.M.*, xvii, p. 205] resistance to the disease was closely correlated with resistance to water-soaking. Variations in reaction to natural water-soaking were also observed between different species of *Nicotiana* and between tomato, oats, and maize varieties. In the case of oats, a correlation was experimentally demonstrated between liability to water-soaking and susceptibility to halo blight (*Phytomonas* [*Pseudomonas*] *coronafaciens*).

Kikuta (K.), Hendrix (J. W.), & Frazier (W. A.). **Pearl Harbor a Tomato variety resistant to spotted wilt in Hawaii.**—*Circ. Hawaii agric. Exp. Sta.* 24, 6 pp., 3 figs., 1945.

The Pearl Harbor variety of tomato, stated to have particular value for those

areas in Hawaii where tomato spotted wilt is destructive, has been developed from a cross of the highly susceptible Bounty variety with the very resistant but unfruitful BC-10 [*R.A.M.*, xxiii, p. 7], an F_2 selection of 133–6 × Red Currant × 133–6 received from the California Agricultural Experiment Station. It is thought that Pearl Harbor, although resistant to spotted wilt in Hawaii (0·7 per cent. infected plants as against 47·7 per cent. for Bounty), may not show appreciable resistance to other strains of this virus, and like Bounty it has been observed to be susceptible to other serious diseases of tomato, such as *Stemphylium* leaf spot [*S. solani*], *Fusarium* wilt [*F. bulbigenum* var. *lycopersici*], bacterial wilt, mosaic, and others. It is accordingly recommended for commercial planting only where spotted wilt is severe. When crossed with other varieties, the resistance of Pearl Harbor to spotted wilt is reproduced in plants of the F_1 generation. Consequently F_1 hybrid seed, with Pearl Harbor as one parent, can be used as a means of combating spotted wilt.

Forest Research in India and Burma, 1942–43. Part I. The Forest Research Institute.—144 pp., 1944. [Received December, 1945.]

The following items of interest occur on pp. 77–81 of this report [cf. *R.A.M.*, xxi, p. 399]. The fungi *Asterostomella rhodospora* and *Stereum fasciatum*, the causal agents of heart rot of bird cherry [*Prunus padus*], oak, and maple, have been grown in culture. *Trametes serialis* [ibid., xxii, p. 506] was isolated from Sitka spruce [*Picea sitchensis*] imported from Canada for aircraft construction, infection manifesting itself by brown spots, with decay of the woody tissues as the disease developed and the forming of pockets or even of shakes and cracks. On plantations of the Silvicultural Demonstration Area New Forest teak (*Tectona grandis*) trees were attacked by a new canker disease, which killed many young trees of 10 to 20 in. in girth. A species of *Stylonectria* was identified as the causal agent and its activities form the subject of a special paper.

LONG (W. H.). **Polyporus farlowii and its rot.**—*Lloydia*, viii, 3, pp. 231–237, 4 figs., 1945.

In the United States *Polyporus farlowii* appears to be confined to semi-arid, hot localities. Its northern limit is northern New Mexico, its eastern boundary west Texas, while to the west it extends as far as the Pacific; its southern limit has not yet been ascertained. At Phoenix, Arizona, all kinds of ornamental trees, except, probably, elms and ashes, are badly attacked by heart rot due to this fungus. This applies particularly to pepper trees (*Schinus molle*), cottonwoods [*Populus* spp.], willows [*Salix* spp.], box elders [*Acer negundo* and vars.], elders (*Sambucus* spp.), and mulberries (*Morus* spp.). The pepper tree appears to be specially susceptible, followed by *S. mexicana*; as a rule every bush of the latter host which has attained a diameter of 4 in. at the ground is found locally to have the heartwood destroyed by the fungus, the rot extending even into the small branches if they have any heartwood. On the other hand, the fungus, for some reason not yet determined, is very rare on pepper trees in Los Angeles. The rot caused by *P. farlowii* is of the cylindrical type and usually extends completely to the sapwood, so that branches are readily broken off or the trunks split. The heartwood is not entirely destroyed and the texture and colour of the wood do not appear to have been appreciably changed.

P. farlowii (syn. *P. munzii*, *Inonatus schini*) [*R.A.M.*, ix, p. 753] is described as having annual sporophores, spongy and watery when fresh, firm and rigid when dry, single or imbricated, ungulate and dimidiate or irregular, 4 to 22 cm. side to side, by 4 to 18 cm. front to back, by 1 to 13 cm. thick. The surface, strongly hispid when fresh, often becomes glabrous with age, the upper surface chestnut-brown from the dense, hirsute pubescence, azonate, margin thick or thin, obtuse or acute. The sterile zone is 1 to 6 mm. wide, and 1 to 2 cm. or more thick. The

context is hazel. The tubes are avellaneous to tawny, angular, oval, or irregular, and 1 to 20 mm. long, the setae brown, straight, or cat-claw-shaped, and 8 to 10 by 20 to 30 μ. The pores, angular at maturity, 4- to 6-sided, are 2 to 4 per mm. and the smooth, oval, light brown spores measure 6 to 10 by 4 to 7 μ.

The only remedy for the disease is to prevent entrance by removing dead limbs and protecting the tree against wounds that reach the heartwood. If a wound is present, the damaged bark should be removed, and the exposed surface treated with shellac or white lead paint.

MARTÍNEZ (J. B.). **El estado actual del problemo de la grafiosis del Olmo.** [The actual status of the problem of Elm graphiosis.]—*Montes, Madr.*, i, 2 pp. 48–56, 9 figs., 1945.

The available information concerning the reactions of European, Asiatic, and American elms to *Ceratostomella ulmi* is summarized [*R.A.M.*, xviii, p. 558 *et passim*]. Applying the knowledge experimentally acquired, notably in Holland and Italy, to the Spanish position in respect of the elm disease, the writer advocates the importation and large-scale diffusion of the Buisman elm (a variety incorporating some features reminiscent of *Ulmus foliacea* and others of *U. pirocera*) in Spain, the acclimatization of the highly resistant *U. pumila*, and hybridization of the last-named with the Buisman elm and indigenous species.

HIRT (R. R.) & LOWE (J. L.). **Danger of decay in poorly seasoned lumber.**—*J. For.*, xliii, 10, pp. 717–718, 1945.

The recent imperative demands for timber in the United States have brought a quantity of poorly seasoned material on the market, and two cases of rapid and serious decay by *Poria microspora* [*R.A.M.*, xxiv, p. 300] in houses constructed with such wood in New York State are described. In one of the houses the woods used for studs, sheathing, and siding were Douglas fir [*Pseudotsuga taxifolia*], southern pine [*Pinus* spp.], and western red cedar [*Thuja plicata*], and in the other the subflooring was of southern hard pine [*P.* spp.]. In the former instance the removal of the rotten wood and the application to the new repair material of a modern preservative containing 4 per cent. zinc naphthenate arrested the progress of infection, though 'bleeding' continued in the untreated spots in shaded portions of the walls.

BLUMER (S.). **Über ein starkes Auftreten des Hausschwammes (Merulius domesticus Falck) im Herbst 1942.** [On a severe outbreak of dry rot (*Merulius domesticus* Falck) in the autumn of 1942.]—Abs. in *Mitt. naturf. Ges. Bern*, c, pp. xxix–xxx, 1943. [Received December, 1945.]

From September to December, 1942, 14 cases of dry rot (*Merulius domesticus*) [*M. lacrymans*] were brought to the writer's notice, and these certainly represent a mere fraction of all those occurring in Switzerland during the same period. The unusual prevalence of the fungus is attributed to the inadequacy of the heating facilities during the previous winter.

FISH (S.). **The Plant Research Laboratories, Burnley wartime activities.**—*J. Dep. Agric. Vict.*, xliii, 9, pp. 386–388, 1 fig., 1945.

In this short survey of war work at the Burnley Plant Research Laboratories, Victoria, it is stated, *inter alia*, that all cabbage and cauliflower 'mother' seed used in Victoria during the past three years has been treated at the Laboratories for the Commonwealth Vegetable Seeds Committee, and most of the celery seed commercially used in the Melbourne area, celery leaf spot [*Septoria apii*] being successfully controlled by the use of treated seed.

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VAN VLOTEN (H.). **Is verrijking van de mycoflora mogelijk? (Naar aanleiding van de Populierenroest).** [Is enrichment of the mycoflora possible? (With reference to Poplar rust).]—*Tijdschr. PlZiekt.*, l, 5–6, pp. 49–62, 4 pl., 1944. [English summary.]

Following a general discussion as to the possibilities of enrichment of the mycoflora of a country, illustrated by some well-known concrete examples, the author treats in greater detail the distribution of poplar rusts (*Melampsora* spp.) over the globe and the well-founded risks of the reciprocal transmission of North American species into Europe and of European ones into North America. To avoid misapprehension it is pointed out that the term 'enrichment' of the mycoflora is strictly applicable to the development of new elements through introduction from other countries, by hybridization, and by fungal mutations, but not to the simple detection of a hitherto unknown fungus, which may merely have escaped observation.

With one exception all the poplar rusts are heteroecious, the single known autoecious species being that originally described by Barclay from the Himalayas as *M. aecidioides* on *Populus alba* (*J. Asiat. Soc. Beng.*, lx, 2, pp. 211–230, 1891) and in 1933 recorded by Arthur and Cummins under the same name from Kashmir [*R.A.M.*, xiii, p. 185]. According to Klebahn (Kryptogamenflora der Mark Brandenburg, Pilze III, 1914), *M. aecidioides* is a collective name for four species occurring on *P. alba* in Europe, viz., *M. larici-tremulae*, *M. pinitorqua*, *M. magnusiana*, and *M. rostrupii*, while Jørstad [*R.A.M.*, xv, p. 618] unites the same four under the designation of *M. tremulae*, with *M. aecidioides* as a possible fifth, the extra-European stations of which are probably introductions. Apart from this virtually ubiquitous species, the poplar rusts are more restricted in their distribution, and the European species, e.g., *M. larici-populina* and *M. allii-populina*, fall into quite a different category from the typical North American *M. medusae* [ibid., xix, p. 240; xxii, p. 498], *M. albertensis* [ibid., xxi, p. 173; xxii, p. 503], *M. abietis-canadensis* [ibid., xxii, p. 434], and *M. occidentalis*. The two European species have spread over great distances, *M. larici-populina* having been reported, for instance, by Hiratsuka from Japan [ibid., xi, p. 405] and Fresa from Argentina [ibid., xvi, p. 5], and *M. allii-populina* from Morocco [ibid., xvi, p. 207], Palestine [ibid., xv, p. 683], and Argentina [ibid., xvii, p. 83].

With the aid of a special laboratory technique the writer demonstrated the development in 1941 of three physiologic races, (a), (b), and (c), and a white variant (d), closely resembling (c), of *M. larici-populina*, which were mutually distinguishable by the reactions to inoculation with them of eight poplar varieties. Thus, (a) from *P. marilandica* and (b) from *P. eugenii* can be differentiated by their effects on *P. candicans*, which is susceptible to the former and immune from the latter, while both are entirely distinct from (c) and the white variant from *P. candicans*. Inoculations on the last-named species with (c) and the variant resulted in damage exceeding any previously observed by the writer over a protracted period in Holland: premature defoliation was the rule, and the few leaves still

attached to the tree at the beginning of September were extensively discoloured and covered with uredo- and teleutosori. *P. serotina* is susceptible to all three races and the variant; *P. regenerata* moderately susceptible and susceptible, respectively, to (a) and (b), and semi-immune and immune, respectively, from (c) and the variant; *P. marilandica* susceptible to (a) and (b), fairly resistant to (c), and moderately susceptible to the variant; *P. eugenii* fairly resistant to moderately susceptible to (a), susceptible to (b), resistant to (c), and semi-resistant to the variant; *P. robusta* susceptible to all four—lightly so to (a); *P. gelrica* semi- to moderately resistant to (a), moderately susceptible to susceptible to (b), and resistant to or immune from (c) and the variant; *P. candicans*, the reactions of which to the last-named have already been discussed, is susceptible to (a) and immune from or resistant to (b); and, finally, *P. generosa* is fairly resistant to moderately susceptible to (a) and (c), fairly resistant to (b), and resistant to moderately susceptible to the variant.

The development of the new races is assumed to be due to the interplanting of larches (the alternate host of *M. larici-populina*) among the poplars in the experimental plot, thereby affording opportunities for interracial hybridization. Like the adventitious introduction of foreign species, this method of enrichment of the existing rust flora adds an element of uncertainty to the work of breeding for resistance.

Vanselow (A. P.). **The minor element content of normal, manganese-deficient, and manganese-treated English Walnut trees.**—*Proc. Amer. Soc. hort. Sci.*, xlvi, pp. 15–20, 1945.

Spectrographic analyses of leaves from treated and untreated manganese-deficient walnut trees and from normal walnut trees showed that manganese deficiency can be remedied by spraying in early summer with manganese sulphate or by injection of the dry salt into the trunk or limbs.

Robak (H.). **Cultural studies in some Norwegian wood-destroying fungi. A biological study and a contribution to diagnostics of wood decay.**—*Medd. Vestland. forstl. Forsøksst a.* 25, 248 pp., 11 pl., 8 figs., 25 diags., 10 graphs, 1942. [Nor wegian summary. Received November, 1945.]

The tetrapolar segregation of the sexes previously demonstrated or suggested in the author's studies of *Stereum purpureum*, *Corticium evolvens*, and *Polyporus* [*Polystictus*] *abietinus* [*R.A.M.*, xvi, p. 7] has been confirmed by further work, while *Lenzites sepiaria* and *Trametes serialis* were again shown to pursue a bipolar course of sexual differentiation. *T. odorata* [ibid., xviii, p. 215] also proceeded along bipolar lines, though staling phenomena in the culture media greatly impeded observations on this species.

From a cytological investigation of *S. sanguinolentum* it is concluded that in the majority of the basidia spore formation is parthenogenetic, any caryogamy that may occur taking place between sister nuclei.

Two Norwegian strains of *S. purpureum* were interfertile, as were also the same strains and a Canadian isolate referred to *S. rugosiusculum* Berk. & Curt. [ibid., xix, p. 239]; the latter name is therefore regarded as a synonym of the former. Interfertility also characterized the Norwegian strains of *P. abietinus*. All the Norwegian isolates of *L. sepiaria* were interfertile, as were also some Norwegian and Canadian isolations. All the Norwegian strains of *T. serialis* were interfertile, but a Canadian isolate of the same fungus did not intermingle with them at all. Although so closely similar in colour, texture, and pathogenicity, *L. sepiaria* and *T. odorata* (*T. americana* Overh.) were quite intersterile [ibid., xv, p. 761], and there seems to be no valid reason to follow American procedure in uniting the two species under the former name [ibid., xiv, p. 795].

The cultural characters of the fungi under discussion are exhaustively described

and discussed in relation to their application for diagnostic purposes. The optimum temperature for the development of *C. evolvens* and *S. sanguinolentum* was 23° C. or below, *S. purpureum* throve at 23° to 26°, *P. abietinus* and *T. serialis* at 27° to 28°, *T. odorata* at 28° to 30°, *L. sepiaria* at 32°, and the above-mentioned Canadian isolate of *T. serialis* at 35°.

The dry-weight losses caused by *L. sepiaria, T. serialis,* and *T. odorata* in pine and spruce sap and heartwood chips and blocks and spruce sapwood sawdust were roughly comparable, while those due to the action of *P. abietinus* and *S. sanguinolentum* were considerably lower in the chip and sawdust cultures but not in the blocks; in one pine sapwood block, in fact, *S. sanguinolentum* was responsible for more severe decay than any of the other species tested. *C. evolvens* and *S. purpureum* caused only negligible reductions in weight. The brown to brownish-red discolorations of the wood induced by the two species of *Stereum* and *P. abietinus* was often preceded in the case of *S. sanguinolentum* by a pale rose-mauve tinge. The observations made in this connexion on *P. abietinus* point to its implication in the etiology of the prevalent brownish-red storage rots of timber and pulp wood.

The two members of the brown-rot group, *T. serialis* and *L. sepiaria,* caused the expected heavy losses in cellulose and also, at an advanced stage of infection, considerable lignin decomposition [ibid., vi, p. 453; x, p. 148, *et passim*]. The white-rot fungi, *S. sanguinolentum* and *P. abietinus* [ibid., xii, p. 343], were less destructive than the foregoing, attacking cellulose and lignin in about equal proportions, with a slight preference for the former. Both groups caused appreciable disorganization of hemicelluloses. Monosporous mycelia of *P. abietinus, L. sepiaria,* and *T. serialis* brought about equally heavy dry-weight reductions with dicaryotic mycelia of the same species. When the three last-named fungi were cultured on spruce sawdust in association with bacteria isolated from decayed wood, an increase in the dry-weight loss occurred only in the case of *L. sepiaria.*

A ten-page bibliography is appended.

Reinmuth (E.). **Untersuchung über die Kohlherniebekämpfung durch Kalk.** [Investigations on Cabbage club-root control by means of lime.]—*Angew. Bot.*, xxv, 5–6, pp. 368–378, 4 figs., 1943. [Received November, 1945.]

From 1937 to 1942 the possibilities of combating crucifer club root (*Plasmodiophora*) [*brassicae*] in white mustard and *Camelina sativa* by means of lime [*R.A.M.*, iii, p. 620 *et passim*] were investigated at the Rostock (Germany) Agricultural Experiment Station. In pot tests in which caustic lime was applied at the rate of 2 kg. per sq.m. to the inoculated soil on 30th November, 1936, 4th January, 8th February, 15th March, 19th April, or 24th May, 1937, neither plant developed infection except in the final series, where the incidence amounted to 8·3 per cent. in mustard and 8·8 in *C. sativa*, the corresponding figures for the controls being 91·6 and 100 per cent., respectively. The soil P_H rose steadily from 7·9 to 8·5 up to and including the 19th April treatment; in the 24th May pots it was 7·9, and in the controls 6·2. In this connexion it is of interest to note that the P_H of the 30th November and 24th May series were identical, though the results of the earlier treatment were entirely satisfactory and those of the latter only partially so. In an outdoor trial in the following year, in which lime was applied on the same dates, all the treatments were equally effective in both crops apart from 1 per cent. infection on mustard in the February plots; in the controls the incidence of club root in mustard and *C. sativa* amounted to 44·5 and 6·9 per cent., respectively. In combined pot and field trials in 1938–9 the average percentage of infection in mustard ranged from 2·6 per cent. in the November series to 21·8 in that of March, sinking again to 19·3 in the May tests; in the case of *C. sativa* the minimum of 1 per cent. developed in the January, and the maximum of 12 in the May series.

The January and February treatments resulted in the most vigorous development of mustard and *C. sativa*, respectively.

In all the foregoing trials the soil amendment was applied directly to the test crop, and the question arose whether comparable effects could be secured by earlier treatments. Lime was accordingly applied in the autumn of 1939 to the carrot crop preceding the crucifers and found to give equally good control with the direct treatment, besides incidentally benefiting the carrots. In the untreated control plots there was 78·5 per cent. club root in the mustard and 10·2 in *C. sativa*.

In an experiment started on 9th April, 1942, to find the minimum dosage of lime required for effective control of *P. brassicae* on mustard, the crop produced by a sowing made on 12th May and treated with 1 kg. per sq.m. was perfectly healthy, while 2 per cent. infection developed in that sown on 23rd June and receiving the same quantity of fertilizer. Lower dosages of lime failed to prevent infection, though they somewhat mitigated its severity in the early-sown plots; such a degree of control, however, would scarcely be adequate, over a large acreage. At the rate of 1 kg. the soil amendment induced a P_H of 8·4, which lies well above the recorded limits for infection by *P. brassicae*.

WALKER (J. C.) & HOOKER (W. J.). **Plant nutrition in relation to disease development, II. Cabbage clubroot.**—*Amer. J. Bot.*, xxxii, 8, pp. 487–490, 1945.

After pointing out that cabbage yellows (*Fusarium oxysporum* f. *conglutinans*) [*F. conglutinans*: *R.A.M.*, xxiv, p. 484] may be classed as a hypoplastic disease, whereas cabbage club root (*Plasmodiophora brassicae*) is hyperplastic, and that Pryor's work on nutrients in relation to club root [ibid., xx, p. 147] indicated a response to nutrition at variance with that of yellows, the authors describe investigations carried out on the development of club root in young cabbage plants in relation to salt concentration and balance in the nutrient solution.

The results obtained showed that increase in salt concentration in a balanced solution tended to increase the disease index. Excess of potassium and of nitrogen increased it, while increase of phosphorus was of small effect. Omission of potassium or phosphorus generally decreased the disease index, whereas omission of nitrogen increased it. When light conditions and salt concentration were favourable to the growth of the host, the effect of salt balance was less apparent than it was in conditions in which the plants made slower growth.

MORRIS (H. E.) & AFANASIEV (M. M.). **Sugar Beet diseases and their control in Montana.**—*Bull. Mont. agric. Exp. Sta.* 427, 22 pp., 17 figs., 1945.

In this semi-popular account of the diseases of sugar beets in Montana it is stated that seedling diseases or 'black root' [cf. *R.A.M.*, xxii, p. 508] are of considerable importance, especially on the heavy, irrigated soils. Several organisms may be involved, and a slight difference in soil composition, soil temperature, or other factors may be responsible for variation in the pathogens causing the diseases. The most typical form of seedling disease locally is characterized by a browning and blackening of the hypocotyl and root, the discoloration generally extending above the ground. The death of the seedling may be rapid to very slow, and an affected plant often has a completely blackened hypocotyl, though its cotyledons may long remain turgid and green. *Phoma betae* and Phycomycetous fungi are associated with this type of disease. Studies on control showed that seed treatment is of doubtful benefit, but high fertility, due balance, and good physical condition of the soil are of great importance. The nature of the preceding crops influenced the amount of disease present, which increased progressively when the beets were planted after maize, potatoes, oats, lucerne, beans, and beets. The crop should be planted early, and preferably with segmented seeds. The soil should be well drained, and should be cultivated as soon as the drill rows can be

followed. If the disease is prevalent, thinning should be delayed until after the six-leaf stage.

Many fields in the irrigated valleys do not produce satisfactory yields of beets because of phosphorus or nitrogen deficiency, or both [ibid., xxiii, pp. 466, 510; xxiv, p. 87]. Studies at Huntley Field Station showed that beet rotations with lucerne always resulted in more symptoms of phosphorus deficiency than crops in continuous beets or those in two- or three-year rotations which had a very low amount of available phosphorus and nitrogen in the soil, as indicated by yields. To correct soil deficiencies in old lucerne ground the second cutting should be ploughed under at midsummer and then irrigated, in order to favour the decomposition of lucerne remnants during the current season, and make nutrients present in these remnants available for the next crop. The field should be fertilized with phosphorus before the lucerne is ploughed. Slight nitrogen deficiency in sugar beets may cause a rather early yellowing of the tops, while a severe shortage causes yellowing very early in the season, low yields of roots, and no significant response to a phosphate fertilizer. A liberal application of manure, supplemented by nitrogenous fertilizers, corrects the deficiency [cf. ibid., xxiv, p. 86].

Against yellows (*Fusarium conglutinans* var. *betae*) [ibid., x, p. 428; xxii, p. 50] the only feasible control method is a four- to five-year rotation.

Leaf spot (*Cercospora beticola*) [ibid., xxiii, p. 377; xxiv, p. 87] has been present in Montana for many years, but causes economic losses only occasionally in somewhat limited areas. The best methods of control consist in deep autumn ploughing, rotation, spraying with Bordeaux mixture or dusting with monohydrated copper sulphate or a fixed copper compound, and the use of resistant varieties. Against rot due to *Rhizoctonia* [*Corticium*] *solani* [ibid., xxi, p. 400; xxii, p. 284] there is no satisfactory method of control, though soil drainage and crop rotation are beneficial. Miscellaneous root rots, due to various soil fungi, including *Phoma*, *Rhizoctonia*, and *Fusarium*, are best countered by good growth conditions. Crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) [ibid., xxiii, p. 169] occurs occasionally in many fields, but seldom causes serious damage; a long rotation, including maize, small grains, or grasses, will reduce the likelihood of attack. Against curly top, resistant varieties and good cultural practices offer the best protection. Violet root rot (*R. crocorum*) [*Helicobasidium purpureum*: ibid., xix, p. 251; xxiii, p. 354] is of minor importance in Montana; a susceptible crop should not be planted in infected soil until at least four years have passed.

PRICE (W. C.). **The P_H stability of southern Bean mosaic virus.**—*Arch. Biochem., N.Y.*, viii, 1, pp. 13–19, 1945.

The P_H stability range of the southern bean mosaic virus [*R.A.M.*, xxiv, p. 397] was determined for clarified juice samples from Bountiful bean at 3° C. and for purified virus at 3° and 27°. There was little or no difference in the stability of the virus in the two types of preparation, but the P_H stability range was much narrower at 27° than at 3°. The virus was relatively stable for a week at P_H 5 to 6·7 at 27°, and for 37 days at P_H 4 to 8 at 3°. The P_H of maximum stability (5·2 to 6·9) did not coincide with that of maximum infectivity on Early Golden Cluster bean plants, which fell within the somewhat alkaline range of P_H 6·2 to 7·9.

GODFREY (G. H.). **Onion leaf 'blight' reduced by spraying.**—*Plant. Dis. Reptr*, xxix, 23–24, pp. 652–654, 1945. [Mimeographed.]

In a comparison of the respective merits of Bordeaux mixture 5–5–50 and the organic fungicide dithane [*R.A.M.*, xxiv, p. 69] plus zinc sulphate and lime ($1\frac{1}{2}$–1–$\frac{1}{2}$ lb. to 100 gals.), in experiments at the Lower Grande Valley Experiment Station for the control of leaf blight of Bermuda onions due to the fungus *Macrosporium* [*Alternaria*] *porri* [ibid., xxii, p. 237], 89 per cent. of the plants treated with

Bordeaux mixture and 95 per cent. of those treated with dithane survived, as against 70 per cent. in the unsprayed controls, whilst the average number of green leaves per plant were 3·4, 3·7, and 1·9, respectively. The first application was given on 8th January and further applications at weekly intervals. By the time of the third the treated rows stood out conspicuously from the controls, though at the start considerable infection was present.

NIEDERHAUSER (J. S.). **Control of Lettuce gray mold with thiosan.**—*Plant. Dis. Reptr*, xxix, 23–24, pp. 650–652, 1945. [Mimeographed.]

Tests against grey mould (*Botrytis cinerea*) with dust applications made weekly, using approximately 1 to 1½ lb. thiosan [*R.A.M.*, xxiii, p. 32], diluted with talc, per 1,000 sq. ft., showed that the dust markedly reduced infection, from 9·2 per cent. in the control to 0·1 per cent. in plants given eight dustings, and no injury was done to lettuce plants even where the dust was applied at a much heavier rate than usual. There are indications that thiosan might be used effectively for spraying out-of-doors, and more conveniently, as it is irritating if inhaled and a mask was worn in making indoor applications. Dusting tables, of which two are presented, show that the operation is much more effective in the early seedling and pricker stages of growth in reducing the amount of grey mould than after the plants have been set out in the greenhouse beds.

MIX (A. J.). **Aphanomyces rootrot of Lettuce, Pepper, and Eggplant seedlings in northern New Jersey.**—*Plant. Dis. Reptr*, xxix, 23–24, pp. 649–650, 1945. [Mimeographed.]

A root rot disease of lettuce seedlings was observed in northern New Jersey in January, 1945, and subsequently appeared to be caused by a species of *Aphanomyces*, oospores of which were present in the browned cortex of the diseased roots. About half the seed used failed to germinate in unsterilized soil, a number of seedlings soon died, and others put forth new roots and survived. The fungus was isolated, but the culture was lost by delay in making transfer. In April a similar root rot was found affecting [chilli] pepper and eggplant seedlings planted during the abnormally warm weather in March. A species of *Aphanomyces* was isolated from the pepper seedlings, and lettuce seedlings planted in sterilized soil mixed with inoculum of the fungus developed characteristic root-rot symptoms, with oospores present in the browned cortex. Seed sown in sterilized, uninoculated soil produced healthy seedlings. No attempt has yet been made to determine the species of *Aphanomyces* involved.

OLIVE (L. S.), BAIN (D. C.), & LEFEBVRE (C. L.). **A leaf spot of Cowpea and Soy-bean caused by an undescribed species of Helminthosporium.**—*Phytopathology*, xxxv, 10, pp. 822–831, 4 figs., 1945.

In August, 1944, cowpea leaves over a 50-acre area near La Place, Louisiana, were severely attacked by a hitherto undescribed species of *Helminthosporium*, which is named *H. vignae* Olive, n.sp. and was subsequently found to be associated with specimens of the same host from North and South Carolina, and also with soy-beans similarly affected in Florida in 1943.

The first symptoms of the disease, to which the common name of 'target spot' is applied, on cowpea leaves are reddish-purple dots, gradually expanding into prominent, brown, circular areas, often surrounded by wavy margins, and nearly always zonate at maturity, when the reddish-brown rings stand out against a paler brown background. In the final stages of infection the dead brownish tissue may rupture and fall out, leaving holes in the leaf suggestive of insect depredations. Very severe cases are characterized by chlorosis of the entire leaf and defoliation.

Most of the Louisiana specimens bore up to 50 or more zonate lesions, mostly 3 to 10 mm. in diameter, with a maximum of 2 cm. and a larger number of small, purplish, undeveloped spots. Later in the season the fungus was found to be producing numerous reddish-purple spots and streaks on the stems and petioles of cowpeas already debilitated by acute foliar infection; other organisms were usually concerned in this phase of the disease, and no doubt contributed to the intensity of the damage. The symptoms of the disease on soy-bean leaves were mild and the stems were not attacked.

In culture on Czapek's solution agar or potato dextrose agar *H. vignae* is characterized by dusky brown conidia, cylindrical or tapering towards the apex, often curved, usually occurring in chains of 2 to 5, 26 to 204 by 7 to 12 μ, 0- to 15-septate, borne on uni- to quadriseptate conidiophores, 26 to 440 by 4·5 to 8 μ, and hyaline chlamydospores, 16 to 30 by 14 to 20 μ. In nature the conidial dimensions range from 40 to 270 by 8 to 19 (average 100 to 180 by 15 to 18) μ, and the number of septa from 3 to 20 (10), the corresponding figures for the conidiophores being 44 to 380 (or 490) by 6 to 11 (typically 125 to 200 by 8) μ and 1 to 20 (3 to 5) septa.

H. vignae comprises two physiologic races, of which 1, isolated from Louisiana cowpea leaves, caused severe spotting of its own host in inoculation experiments and mild symptoms on soy-bean, and 2, derived from Mamredo soy-beans in Florida, induced light spotting of soy-bean and few to many very small spots of little consequence on cowpea foliage. The Iron cowpea variety sustained particularly heavy damage from race 1, Early Buff and Early Silver Crowder were also severely attacked, while Blackeye was the least affected.

Boswell (V. R.). **Disease resistant and hardy varieties of vegetables.**—*Nat. hort. Mag.*, xxiv, 4, pp. 268–273, 2 figs., 1945.

Continuing his useful survey of the present situation in the United States in respect of disease-resistant and hardy vegetable varieties [*R.A.M.*, xxiv, p. 216], the writer presents the latest information [already noticed in this *Review* from other sources] on tomatoes and chilli peppers resistant to wilt (*Fusarium* [*bulbigenum* var. *lycopersici* and *F. annuum*]), respectively, and a note on resistance to diseases in general in eggplants.

Boynton (D.). **Potassium deficiency in a New York Grape vineyard.**—*Proc. Amer. Soc. hort. Sci.*, xlvi, pp. 246–248, 1 fig., 1945.

In the summer of 1943, the third growing season after planting, Ontario, Niagara, Brighton, Portland, Caco, and Delaware vines in a vigorous three-acre vineyard near Penfield, New York, developed interveinal chlorosis and marginal leaf scorch. By harvest time almost all the leaves on many vines of the Delaware and Portland varieties were rolled and shrivelled or had abscissed. Foliar analyses showed that in the affected leaves potassium was very low and calcium and magnesium extremely high. Samples of surface soil from the affected area contained only half as much replaceable potassium as those from places where the symptoms were less severe, and analyses of leaves from slightly affected vines showed higher potassium than in those severely scorched.

In 1944, 240 vines of the varieties Delaware, Caco, and Ontario in the area affected the previous year were treated as follows: (*a*) $\frac{3}{4}$ lb. 60 per cent. potassium chloride in April and again in June, (*b*) no treatment, (*c*) as (*a*) plus 1 oz. borax in April and again in June, and (*d*) borax as in (*c*) but no potassium chloride. On 7th September the numbers of groups of three vines (considered as a single sample) that showed severe scorch were 0, 10, 0, and 5 for the four treatments, respectively, the corresponding percentages of potassium in the leaves (dry-weight basis) being 0·69±0·031, 0·36±0·034, 0·68±0·077, and 0·3±0·023. Response to the treatments was the same for all varieties. It seems evident that increase in leaf

potassium was associated with partial recovery from scorch, and further improvement is expected to follow another season's treatment.

CHRISTOFF [KHRISTOV] (A.). О цвѣтване на вируситѣи вируситѣ тѣла. [Staining of viruses and virus bodies.]—*Спис. земед. Опит. Инсти България.* [*J. agric. Exp. Stas Bulgaria*], xi, 3, pp. 43–50, 1941. [English summary. Received December, 1945.]

The author presents the results of his studies on the staining of pure viruses and of virus bodies in the cells of infected plants. In the first series of tests pure preparations of viruses were shown to differ in their reaction to dyes. Ordinary tobacco mosaic virus and potato virus X were found to exhibit common reactions to many dyes, while tomato bushy stunt virus showed in several respects different affinities; and in the case of certain dyes the response of tobacco mosaic virus and potato virus X was different.

In tests with infected plant material the results of staining tobacco mosaic virus particles were the same as those in the case of pure preparations of the virus. In tests undertaken with epidermal strips from the lower surface of leaves the inclusion bodies of severe etch [a strain of tobacco etch virus] and ordinary tobacco mosaic virus showed many distinctive reactions of the independent hosts on which they occurred [cf. *R.A.M.*, vii, p. 650; xix, p. 160]. Two tables, one showing the colour reactions of tobacco mosaic virus, potato virus X, and tomato bushy stunt to 65 dyes in acid and alkaline solutions, and the other that of nuclei, tobacco mosaic virus crystals, and severe etch virus bodies in tobacco and tomato plants to 23 dye treatments are provided. The reactions in the second table are considered to give some idea as to the possibility of developing sound methods for single or group determination and diagnosis of virus diseases through their virus bodies. There is a bibliography of 44 titles.

VANDERWALLE (R.). **Observations et recherches effectuées à la Station de Phytopathologie de l'État pendant l'année 1941.** [Observations and researches carried out at the State Phytopathological Station during the year 1941.]—*Bull. Inst. agron. Gembloux*, xi, 1–4, pp. 147–156, 1942. [Flemish, English, and German summaries. Received January, 1946.]

In this report [cf. *R.A.M.*, xxiv, p. 491] it is stated, *inter alia*, that during 1941 wheat lodging (*Cercosporella herpotrichioides*) [ibid., xxiv, p. 183] was very prevalent in the vicinity of Gembloux, Belgium, and distinct differences in varietal susceptibility were observed. In one locality wheat glume blotch (*Septoria glumarum*) [*S. nodorum*: ibid., xx, p. 249; xxiii, p. 11] was unusually prevalent; the fungus appeared to be, to some extent at least, responsible for an appreciable amount of whiteheads.

About mid-April barley was attacked by *Marssonina graminicola* [*Rhynchosporium secalis*: ibid., xxiii, p. 89]. Severity of infection differed with the variety, and the symptoms generally disappeared following applications of nitrate, though on some varieties infection was intense and produced complete destruction of the foliage.

Potatoes were attacked by *Corticium vagum* [*C. solani*] during growth at the lenticels in the manner described by G. B. Ramsey in 1917 (*J. agric. Res.*, ix, pp. 421–426) [see also *R.A.M.*, xxi, p. 38]. The neighbouring parenchyma produced layers of corky tissue, accumulating to form pustules, which later became hollow and cylindrical, measuring 10 to 12 mm. long by 6 to 7 mm. in diameter. Tissue change generally remained quite local. Affected tubers should be eliminated.

Many complaints were received from growers of the prevalence on azaleas [*Rhododendron* spp.] of *Exobasidium azaleae* [*E. vaccinii*: ibid., ix, p. 389; xxiii, p. 346] and, particularly, of *Septoria azaleae* [ibid., xxi, p. 122]. In the vicinity of Namur

plum leaf spot and shot hole (*Ascospora beijerinckii*) [*Clasterosporium carpophilum*] appeared to be decreasing. Canadian poplars were commonly attacked by *Taphrina aurea* [ibid., xiv, p. 665] and *Dothichiza populea* [ibid., xxii, p. 183].

Faes (H.). **Station fédérale d'essais viticoles et arboricoles à Lausanne et Domaine de Pully. Rapports annuels 1943 et 1944.** [Annual reports for 1943 and 1944 of the Federal Viticultural and Arboricultural Experiment Station at Lausanne and Domaine de Pully.]—*Annu. agric. Suisse*, xlvi, 8, pp. 671–707, 1945.

Among other items of phytopathological interest in these reports [cf. *R.A.M.*, xxiii, p. 91] are the following. In co-operation with several other Swiss stations, further experiments were undertaken to determine the prospective value of copper-saving formulas for vine downy mildew [*Plasmopara viticola*] control. Satisfactory results were obtained with 1 and 1·5 per cent. Bordeaux mixture, 0·75 per cent. Bordeaux plus 0·4 per cent. magnesium sulphate, 0·3 per cent. Sandoz, 1 per cent. Bayer 2317 plus 0·1 per cent. copper Sandoz, and 1 per cent. Bayer 1192 A plus 0·2 per cent. copper Sandoz. Under conditions or in localities particularly favourable to the development of the pathogen, as in the canton of Ticino in 1944, it is advisable to raise the strength of Bordeaux to 1·5 and that of copper Sandoz to 0·4 per cent. after flowering for the protection of the grapes.

Applied in good time (12 hours at the latest after a hail shower), oxyquinoline (cryptonol or tumex) in liquid form gave promising results in the control of 'coître' (*Coniothyrium diplodiella*), but as a dust it was disappointing. Sprayed on the grapes as soon as possible after hail, a weak solution of pure copper sulphate (300 to 400 gm. per hectol. water) mitigates the injuries inflicted by the fungus to some extent. Field observations have shown the definite superiority, in respect of resistance to *C. diplodiella*, of hybrid bearers with their tougher leaves over Chasselas.

For the effective control of Oidium [*Uncinula necator*] the sulphur content of dusts should on no account be less than 40 per cent.

The abnormally dry and fairly hot summers of 1942, 1943, and 1944 were conducive to virulent outbreaks of 'roter Brenner' [*Pseudopeziza tracheiphila*: ibid., xx, p. 515], and the necessity for economy in the use of copper precluded effectual control measures, which should be instituted as soon as the shoots attain a length of 5 to 10 cm.

Apple scab (*Venturia*) [*inaequalis*] did not flourish under the weather conditions prevailing in the years covered by the reports, but mildew (*Podosphaera* [*leucotricha*]) occurred in a severe and persistent form on certain varieties. A spraying schedule of three successive applications, two before and one after the blossom, of lime-sulphur plus a wetter or wettable sulphur, gave moderately good control, but an entirely satisfactory programme has still to be drawn up.

Peach mildew (*Oidium*) [*Sphaerotheca pannosa*] has also been in evidence of late years; in Ticino encouraging results have been obtained in experiments with pomarsol.

Experiments were carried out on Monte Ceneri in the hope of finding a means to arrest the spread of chestnut ink disease [*Phytophthora cambivora*] and rehabilitate the less severely injured trees. A hopeful line of approach to the problem consisted in the exposure, before the onset of winter, of the root-collar and large roots over a radius of 8 to 10 m. to subject the pathogen to the influence of air and cold; the application to the exposed surfaces of a carbolineum solution; and two treatments, during the vegetative period, with a copper sulphate solution or copper dust.

Soil disinfection against fungal pathogens may be effected in the seed-bed by means of steam at 95° to 100° C.; 1 per cent. formalin, watered over well-prepared soil at a dosage of 8 to 10 l. per sq.m. at least a fortnight before sowing or planting;

and (on a small scale) dilute solutions of copper sulphate (0·5 to 1 per cent.) without lime, applied by watering immediately after sowing.

MILLER (R. W. R.). **Annual Report, Department of Agriculture, Tanganyika Territory, 1944.**—8 pp., 1945.

On p. 7 of this report [cf. *R.A.M.*, xxiv, p. 8] it is stated that during 1944 wheat in the Northern Province of Tanganyika Territory was rather severely affected by *Puccinia graminis* and *P. glumarum*, the latter occurring at all elevations. Potato blight (*Phytophthora infestans*) was present at Kasulu, Western Province, and Mbeya, Southern Highlands Province; the disease has now been found in all the important potato-growing areas in the Territory. The bacterial ring rot of potatoes recently reported from Kenya [ibid., xxiv, p. 200] was observed in one field in the Usambara Mountains in a crop from imported seed. Tomato blight (*P. infestans*) was recorded. *Pythium aphanidermatum* was isolated from root rot, and *Phytophthora parasitica* from fruit rot, of papaws [ibid., xxiii, p. 235]. A sweet potato virus disease, which is also present in Uganda and the Belgian Congo [ibid., xxiv, p. 442], caused heavy loss in the Lake Province.

Rapport pour les exercices 1942 & 1943. [Report for the years 1942 and 1943.]—*Publ. Inst. nat. Étud. agron. Congo belge*, 154 pp., 1944.

In this report [cf. *R.A.M.*, xxiii, p. 431] it is stated (pp. 16–24) that the Stoneville cotton variety is not very susceptible to artificial infection with stigmatomycosis (*Nematospora coryli* and *N. gossypii*).

Further studies on the resistance of coffee varieties to *Colletotrichum coffeanum* [*Glomerella cingulata*: loc. cit.] indicated that of those tested L(ocal) B(ronze), L.B. 8, L.B. 9, L.B. 10, and L.B. 12 are the most resistant, while the Mysore lines are the most susceptible. Different Bordeaux treatments reduced infection by from 22 to 33 per cent.; the use of fungicides against *G. cingulata* is often disappointing, possibly because of the presence of latent infection in the fruits, floral buds, and hypocotyl. A species of *Cladosporium* destroyed the root cap of young *Cinchona* seedlings. *Fusarium* and *Verticillium* were isolated from *Cinchona* plants affected with tracheomycosis, but an unidentified organism successfully induced the symptoms of the disease on inoculation. *Armillaria* [*mellea*] caused much damage to *Cinchona* on land previously under forest.

Maize diseases so far identified at Gandajika include *Sclerospora maydis* [ibid., xxiii, p. 432], *Diplodia zeae* on the ears, *Puccinia sorghi*, *Physoderma zeae-maydis* [ibid., xiii, p. 691], and streak. *S. maydis* is the most serious parasite of maize locally, and the disease was widespread in 1942. Only resistant varieties should be planted. Maize streak is rather prevalent, but causes less important damage than *S. maydis*.

No resistance to groundnut rosette [loc. cit.] has been observed, and the only remedy is close planting.

Bean (*Phaseolus* sp.) cultivation is greatly handicapped by the presence of *Uromyces appendiculatus* [loc. cit.], though some native varieties appear to be immune.

THOMSON (BETTY F.). **Tissue responses to physiologically active substances.**—*Bot. Rev.*, xi, 10, pp. 593–610, 1945.

In this paper the author reviews and discusses the investigations conducted by a large number of workers since 1936 on tissue response in plants to physiologically active substances (such as indoleacetic acid, indolebutyric acid, and naphthalene acetic acid), the main points covered being their effect when applied to various plant parts, delayed tissue maturation due to their application, factors affecting tissue response, their relation to crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*), and the mechanism of tissue response to them.

The evidence shows that the most consistent response of plant tissues to high concentrations of these substances is cellular proliferation. Crown gall causes abnormal growth resembling that induced by synthetic auxins. The precise relation of the presence of bacteria to the auxins apparently involved in gall development remains to be determined.

A bibliography of 66 titles is appended.

Frandsen (N. O.). **Septoria-Arten des Getreides und anderer Gräser in Dänemark.** [*Septoria* species of cereals and other grasses in Denmark.]—*Medd. Vet-Højsk. plantepat. Afd., Kbh.*, 26, 92 pp., 5 figs., 1943. [Received November, 1945.]

It is proposed provisionally to unite a small group of *Septoria* species with bacterioid, *Phyllosticta*-like conidia in a section, *Microseptoria*, within the genus. Three such species are described with the presumably associated macroconidial states, viz., *S. briosiana* Mor., which appears from a study of the relevant literature to be identical with *S. tritici* (*S. graminum*) [*R.A.M.*, xviii, p. 297], *S. gracilis* Passer., possibly representing a phase in the life-cycle of *S. phyllachoroides* Passer., and *S. brachypodina* O. Rostr. There is only one record of *S. nodorum* (on rye) for Denmark, and that is of doubtful authenticity; it occurs in the annual survey of plant diseases for 1923 by E. Gram and S. Rostrup [ibid., iii, p. 506]. The taxonomy, geographical distribution, symptomatology, host range, morphology, physiology, sources and modes of infection, pathogenicity, effects on individual host varieties, economic importance, and control of *S. tritici* and *S. nodorum* are discussed.

The examination of wheat leaves infected by *Ascochyta graminicola* on Fünen in 1930 [ibid., xi, p. 768] revealed conidia with average dimensions of 13 to 18 by 3 to 5 μ, accompanied by some much larger ones (20 to 25 by 5 to 6 μ) and a number of variable forms, including a few triseptate, 18 to 20 by 3 μ. The conidia of all other collections measured 18 to 20 by 4·5 to 6 μ and a third averaged 15 by 4 μ, with a range of 13 to 19 by 3·5 to 5 μ, and were very variable in shape. The same organism was collected on rye in 1941, and on barley in 1931. The writer regards the fungus as a collective species.

According to G. F. Weber, rye is susceptible to infection by *S. tritici* in the United States [ibid., ii, p. 212], but other records of the fungus on this host are of dubious authenticity. *S. secalis* [ibid., xv, p. 745] was collected on rye in Denmark in 1941; its geographical distribution, symptoms, host range, morphology, physiology, and effects are briefly described.

S. avenae [ibid., ii, p. 159 *et passim*] was obtained from oats in 1941. For many years past the fungus has been cited in Danish phytopathological literature as the agent of the so-called 'dark spot disease', but the writer finds no evidence of such a connexion and attributes the discoloration to physiogenic factors, the nature of which is as yet obscure. The desiccated spots produced by *S. avenae* are of a dirty yellowish-white colour, separated by a red-brown border from the surrounding yellowish-green tissue, which gradually merges into the normal. The perfect state of *S. avenae* was reported for the first time by Weber from Wisconsin [loc. cit.] under the name of *Leptosphaeria avenaria*. The fungus is probably of little economic importance.

The species described by Desmazières from France in 1847 (*Ann. Sci. nat.*, Sér. 3, viii, pp. 9–37) as a variety (c. *avenae*) of *S. graminum* was re-examined by Sprague in 1934 and considered to be a physiologic race of *S. tritici* [*R.A.M.*, xiii, p. 434], but the writer finds the grounds for both these attributions unconvincing and prefers to regard the fungus as an independent species, which he names *S. sativa* n.sp. (syn. *S. graminum* Desm. var. c. *avenae* Desm.). A Danish record of the organism (as *S. graminum*) by Rostrup (*Tidsskr. Planteavl*, vi, pp. 38–56, 1900) is thought to rest on a confusion with *S. avenae*.

A specimen of oats from E. Rostrup's herbarium labelled *S. avenae* (1898) also contained a hitherto undescribed *Phaeoseptoria*, to which the name of *P. multiseptata* n.sp. is assigned. It appears to occur invariably as a harmless saprophyte.

A fungus tentatively referred to *S. passerinii* Sacc. (*S. murina* Passer.) was observed on ripe barley plants in north Zealand, this being the first record for Denmark proper, though E. Rostrup's collection reported as *S. tritici* on the same host from the Faroe Islands (1901) may actually have been *S. passerinii*; material for identification is no longer available. The conidia of the Zealand species measure 3 μ in the original diagnosis, but otherwise the specimens are in satisfactory agreement with Weber's description [*R.A.M.*, ii, p. 356], according to which these organs are 1·7 to 3 (mean 2·3) μ in diameter.

E. Rostrup's two collections of *Agropyron acutum* (*A. junceum* × *A. repens*) and one of *A. obtusiusculum* are labelled as harbouring *S. graminum*, but the pycnidial dimensions (150 to 180 by 100 to 120 and 30 to 35, mean 35 by 1·5 μ, respectively), point rather to the identity of the specimen with *S. agrestis* Sacc. (*S. agropyri* Brun., nec. Ell. & Ev.). *S. phyllachoroides* was collected on *A. repens* in north Zealand in 1941.

A species on *Agrostis spica-venti* from Frederikshavn referred by E. Rostrup to *S. agrostidis* and by Lind (the original collector) to *S. bromi* is described by the author as *S. agrostidis* n.sp. It is characterized by spherical or oblong pycnidia, 70 to 170 by 50 to 100, mostly 130 by 90 μ, with brown, parenchymatous walls and an oval ostiole, 30 to 40 μ in diameter, filiform, straight or curved, hyaline, sometimes very indistinctly uni- or biseptate conidia, 30 to 55 by 1 to 1·5 μ. The fungus produces on the leaves and leaf sheaths oblong, ochraceous to brownish lesions supporting large clusters of pycnidia.

An active parasite of *Alopecurus agrestis*, collected by E. Rostrup in Lolland and identified as *S. graminum*, was later referred by Lind to *S. alopecuri* (Karst.) Syd., but the writer does not accept these determinations and names the fungus *S. alopecuri-agrestis*. The pale foliar lesions bear clusters of substomatal, subspherical or oblong pycnidia, 80 to 170 by 50 to 80 (mean 125 by 75) μ, with brown, parenchymatous walls and a subcircular ostiole, and the filiform, straight or curved, hyaline, often indistinctly septate conidia measure 33 to 50 by 1·5 to 2 μ. The species ascribed by Petrak and Esfandiari to *S. graminum* on *A. agrestis* in Persia [ibid., xxi, p. 99] is also believed to be *S. alopecuri-agrestis*.

E. Rostrup's and Lind's Danish collections labelled *S. avenaria* on *Ammophila avenaria* correspond with the original diagnosis of *S. avenaria* Rostr.

A Danish specimen determined by E. Rostrup as *S. graminum* on *Avena elatior* is thought to be identical with *S. bromi* Sacc. var. *arrhenatheri* Grove [ibid., xv, p. 53] on the same host, but as the writer's material differs from *S. bromi* and Grove gives no description of his variety, an independent species is erected as *S. arrhenatheri* (Grove pro var.) n.sp. The substomatal, oblong pycnidia, with brown, parenchymatous walls and an elongated ostiole surrounded by darker tissue, are disposed in long rows in pale, diffuse spots on the leaf sheaths and narrow, cinnamon-coloured stripes on the blades, and measure 75 to 140 by 55 to 90 (mean 110 by 70) μ, and the hyaline, bacterioid, mostly straight, usually uniseptate conidia are 25 to 35 by 1 μ.

Brachypodium silvaticum is a host of *S. tritici*, *S. brachypodina*, *S. brachypodiicola*, *S. brachypodii* Passer., and *S. silvatica* Passer. in Denmark.

Other species occurring on grasses in the country are *S. bromi* on *Bromus secalinus*, *S. calamagrostidis* on *Calamagrostis arundinacea*, *S. epigeios* on *C. epigeios*, *S. elymina* n.nom. (replacing *S. elymi* Rostr., a homonym of *S. elymi* Ell. & Ev.) and *S. elymicola* on *E. arenarius*, *S. festucae* on *Festuca gigantea*, *S. cavarai* n. nom. (*S. graminum* Desm. var. *lolii* Desm., *Ascochyta desmazierii* Cav.) on *Lolium perenne* (new to Denmark), *S. melicae* on *Melica uniflora*, *S. moliniae* on *Molinia*

coerulea, *S. annua* on *Poa annua*, and *S. oudemansii* on *P. nemorosa* (new to Denmark).

Among the *S.* spp. parasitizing grasses is a group with non-septate, half-moon- or boomerang-shaped conidia, several of which produce on the leaf blades and sheaths of their hosts sharply delimited eye spots. It is proposed to separate the representatives of this group from *Septoria* under the name *Lunospora* n.gen., with *L. oxyspora* (Penz. & Sacc.) n.comb. (*S. oxyspora* Penz. & Sacc.) on *Arundo donax* in Italy as the type species. Of the five other species already known, one (*L. culmifida* (Lind.) n.comb. (*S. culmifida* Lind.)) has been found on *Phleum pratense* and probably *P. nodosum* in Denmark. Two new species are described from Denmark, viz., *L. avenae* n.sp., characterized by substomatal, subspherical, brown-walled pycnidia, 40 to 120 by 40 to 70 μ, with a narrow, dark-bordered ostiole, hyaline, unicellular, obliquely half-moon-shaped conidia, 13 to 24 by 2·5 to 3·5 (15 to 17 by 3) μ, which forms on *Avena elatior* leaves small, oblong or rectangular, dirty white, ochraceous to brown- or purple-edged spots; and *L. baldingerae* n.sp., with pycnidia similar to the foregoing, 75 to 120 by 60 to 100 μ, and hyaline, unicellular, falcate conidia, 14 to 16 by 3 μ, the agent of oval or rectangular, grey, brown-edged lesions, 2 to 3 by 1 to 1·5 mm., on *Baldingera arundinacea*. It is further proposed to raise to specific rank, as *L. culmorum* (Grove pro var.) n.sp., *S. oxyspora* Penz. & Sacc. var. *culmorum* Grove on *Dactylis glomerata*, collected in Denmark in 1941.

Gråfläcksjuka. En av manganbrist orsakad växtsjukdom. [Grey speck disease. A plant disease caused by manganese deficiency.]—*Flygbl. Växtskyddsanst., Stockh.*, 75, 4 pp., 4 figs., 1945.

Popular notes are given on the symptoms, etiology, relation to environmental and cultural factors, and control of manganese deficiency disease of various Swedish crops [*R.A.M.*, xxiii, p. 243], including oats, barley, wheat, beets, and potatoes. The most resistant varieties of oats are Fyris, Klockhavre II, and Engelbrektshavre. Ordinary cases of manganese deficiency may be combated by the application to the soil of manganese sulphate at the rate of 50 kg. per ha., but on ground with an abundance of mould or lime in its composition, newly reclaimed marshland, or the drained bottom of a lake, where added manganese is liable to be fixed, the lacking element should be applied in the form of a 1 per cent. solution to the leaves at a dosage of 800 to 1,000 l. per ha. This very economical method of treatment consumes only 8 to 10 kg. manganese sulphate per ha. instead of 50, and may with advantage be used on other soils as well.

Yin (S. Y.). **Notes on physiologic specialization in Puccinia graminis tritici Erikks. and Henn. in China.**—*Phytopathology*, xxxv, 11, pp. 939–940, 1945.

Inoculations on the 12 standard wheat varieties used as differential hosts of *Puccinia graminis* [*R.A.M.*, ii, p. 158] with 175 collections of rust obtained in 12 provinces of China [ibid., xiii, p. 566] from 1942 to 1944 demonstrated the presence in the country, besides 12 physiologic races already known, viz., 10, 11, 15, 34, 39, 40, 95, 107, 115, 122, 143, and 189 [ibid., xxv, p. 30], of two new ones, provisionally designated C_1 and C_2. The former was first isolated from common wheat in Yunnan and then again from Khapli emmer in the nursery, and is distinguishable from all other known races by its infection types on Kota and Vernal (0 and 1++, respectively). It resembles 41 and 42 except on Kanred, which reacts by the 4++ instead of the 0 type of infection. It differs from 72 and 99 in its effects on Little Club and Arnautka. Race C_2 is similar to 122, except that the former produces type 3 and the latter type 1 infection on Vernal. Races 15, 107, and 122 were the most common, having been identified 35, 44, and 24 times, respectively, in the 175 collections, and 122 was the most widespread, occurring in nine of the twelve provinces visited.

VOLOSKY YADLIN (DORA). **Identificación de razos fisiológicas del Puccinia graminis tritici y P. triticina, algunos estudios efectuados en Chile.** [Identification of physiologic races of *Puccinia graminis tritici* and *P. triticina*: some studies carried out in Chile.]—*Agric. tec., Chile* (formerly *Bol. Sanid. veg., Santiago*), v, 1, pp. 70–78, 1945. [English summary.]

In studies at the Department of Plant Breeding and Genetics, Santiago, of the Chilean physiologic races of *Puccinia graminis tritici* and *P. triticina*, Vallega's determination of the existence in Chile of races 11, 14, 15, and 17 of *P. graminis tritici* [*R.A.M.*, xxii, p. 424] has been confirmed. Of 42 varieties and selections of wheat from the United States, five remained entirely immune in inoculation experiments with a mixture of races in which the supervirulent 15 predominated, viz., Kenya 117 K–16–A, Kenya 117 E–B–I–16, Kenya 117 I–5–F, Red Egyptian, and McMurachy, while the remainder were more or less susceptible. The mode of perpetuation of *P. graminis tritici* in Chile is still unknown, and the importance of further studies on this critical aspect of the black rust problem is emphasized.

In addition to the races of *P. triticina* already recorded for Chile, namely, 15, 68, and 114, two new ones have been differentiated under the numbers of 71 and 85. No. 68 is the most widely distributed, having been isolated from samples in seven provinces.

REITZ (L. P.), JOHNSTON (C. O.), & ANDERSON (K. L.). **New combinations of genes in Wheat × Wheatgrass hybrids.**—*Trans. Kans. Acad. Sci.*, xlviii, 2, pp. 151–159, 3 figs., 1945.

Of 33 plants derived from crosses between wheat and *Agropyron elongatum* (from Kansas) back-crossed once or twice to the fourth parent, eight were immune from leaf [brown] rust [*Puccinia triticina*] and all were resistant to stem [black] rust [*P. graminis*] in greenhouse inoculation tests in 1941.

Of 45 plants obtained from back-crossing hybrids between Mindum durum wheat and *A. trichophorum* (California) to the former parent, 37 were quasi-immune from *P. triticina* (physiologic race 9) and the remainder showed considerable resistance in 1944–5. Ten of the plants were quasi-immune from *P. graminis* (race 56), 18 highly resistant, 10 moderately so, 4 were susceptible, and 3 escaped infection. Similar reactions were displayed in 1941 by 22 plants resulting from crosses between wheat and *A. elongatum* obtained from Canada, while the neighbouring fields of common wheat were prematurely killed by excessive rust infection.

In another series of tests on three amphidiploid lines from Canada, viz., Vernal emmer × *A. glaucum*, C.I. 12348, *Triticum turgidum* (49) × *A. glaucum* (1087), C.I. 12349, and Kharkof × *A. glaucum*, C.I. 12351, with races 5, 9, 15, 44, and 126 of *P. triticina*, all the plants were quasi-immune except a few of C.I. 12348, which showed only moderate resistance to race 15. Plants from nine kernels resulting from back-crosses of selection S 4–207 to common winter wheat were grown in the greenhouse in 1945 and found to be virtually immune from race 9 of *P. triticina*, while two reacted similarly to race 56 of *P. graminis* and seven were highly resistant.

In a final series of trials in 1945 on 22 plants of two lines of a cross between wheat and *A. elongatum* (California), all were nearly immune from race 9 of *P. triticina*, while in the case of *P. graminis* (race 56), 7 were quasi-immune, 8 highly, and 8 moderately resistant.

BONNETT (O. T.), WOODWORTH (C. M.), DUNGAN (G. H.), & KOEHLER (B.). **Prairie: a new soft winter Wheat in Illinois.**—*Bull. Ill. agric. Exp. Sta.* 513, pp. 595–600, 2 figs., 1945.

The new soft red winter wheat, Prairie, is resistant to wheat mosaic [*R.A.M.*, xxiv, p. 496], and highly resistant to the physiologic races of black rust [*Puccinia*

graminis] commonly found in Illinois. It is susceptible to leaf [brown] rust [*P. triticina*], loose smut [*Ustilago tritici*], and bunt [*Tilletia foetida*].

Although the Prairie seed distributed to foundation seed-growers in the autumn of 1943 was one year removed from the hot water treated seed, the 1944 crop showed only traces of loose smut. Where infected fields are present, the seed fields of Prairie should be planted to windward of them, or at least 40 rods away. With this precaution Prairie fields should remain almost unaffected. Even if no special precautions are taken against spread, three to five crops can be grown before infection causes much reduction in yield, provided smut-free seed was used at the start. When the head count of a field of Prairie shows 10 per cent. or more loose smut, the seed should be changed.

VANDERWALLE (R.). **Note sur la biologie d'Ustilago nuda tritici Schaf.** [A note on the biology of *Ustilago nuda tritici* Schaf.]—*Bull. Inst. agron. Gembloux*, xi, 1–4, pp. 103–113, 3 figs., 1942. [Flemish, German, and English summaries. Received January, 1946.]

In a study of the mechanism of varietal resistance of different lines of wheat to floral infection by *Ustilago nuda tritici* [*U. tritici*: *R.A.M.*, xx, p. 55], the author made a detailed investigation of mycelial penetration in susceptible and resistant varieties.

It was found that the chlamydospores of the fungus germinate rapidly on the exudate covering the stigmas of both the susceptible and resistant varieties. After some days numerous points of penetration are observed on a level with the thin plumular ramifications of the style. Desiccation of the fine terminal ramifications of the plumules favouring penetration, the mycelium was then detected at the top of the ovary, and was seen to invade progressively all the cells of the outer coverings of the ovary, i.e., the testa. Ten days to a fortnight after infection, the mycelium was clearly visible in the epidermal tissue of the ovary and towards the bottom third. Its presence in this part of the flower does not seem to be due to spread from the top, because between the upper and lower parts of the ovary there is a zone in which the fungus is not present. The marked development of the hyphae at the base of the ovary suggests points of penetration here, and in one instance, penetration appeared to be well established. In the wall of the ovary the hyphae were of rather variable diameter, and progressed in a sinuous but centripetal direction. The mycelium is entirely intercellular and insinuates itself between the host cells by pressure on the cell walls, which thus become detached from the middle lamella; a space is produced and filled with mycelium, forming swellings. Experimental evidence indicated that vegetative transmission of the fungus probably occurs. The density of the mycelium in the embryo probably results from the numerous points of penetration.

A comparative study of experimentally infected embryos from the seeds of susceptible and resistant varieties showed that the embryo of the latter alone was unaffected, so that it is only at this level that an effect of resistance is present. The mycelium disappears in the coverings of the ovary and recurs again there in the mature seed.

As regards the degree of floral infection, the conditions in which infection takes place appear to be much more important than loss of virulence by the mycelium in the seed. Taking slips at the first node failed to eliminate the fungus. Of others made, starting from the second node, some lived and showed no smutted ears at harvest. This seems to show that the mycelium in the vegetative point of the embryo develops rapidly at germination but gradually loses ground with respect to host development and becomes outdistanced, reaching the top of the stem again only when the primordia of the floral organs become differentiated.

No correlation was established between the presence of the fungus in the seed and the germinative energy of the latter. The vitality of the mycelium is very

high and seems to remain quite unaffected even by treatment of the seed with different light rays, colchicin, acenaphthene, and phenylurethane.

Oort (A. J. P.). **Onderzoekingen over stuifbrand II. Overgevoeligheid van Tarwe voor stuifbrand (Ustilago tritici).** [Studies on loose smut II. Hypersensitivity of Wheat to loose smut (*Ustilago tritici*).]—*Tijdschr. PlZiekt.*, l, pp. 73–106, 6 pl., 1 fig., 4 graphs, 1944. [English summary.]

For the study of physiologic specialization in wheat loose smut (*Ustilago tritici*) [*R.A.M.*, xxv, p. 30] 28 spring varieties were inoculated with ten collections of the fungus originating in several countries. In 15 varieties certainly, and in six probably, symptoms of hypersensitiveness were induced by four out of the ten collections, representing three out of six physiologic races (race 1 from Juliana and also from Van Hoek, Holland, race 3 from Peragis 8057, Germany, and race 6 from Peragis selection 368/20, Germany). The most conspicuous feature was marked inhibition of growth, expressed by shortening of the first three leaves, sometimes accompanied by chlorotic striping and spotting and foliar curling. Many plants showing these symptoms (which assume prominence only under greenhouse conditions) die in the two- or three-leaf stage, while the survivors slowly recover, either by means of new growth from the main axis or the development of lateral shoots. Such plants remain small and produce little if any grain, but they are almost invariably free from smut. In the field hypersensitive individuals fail to emerge or make scanty growth, leaving gaps in the stand for which the tillering of the remaining healthy plants only partly compensates. The definitely hypersensitive varieties were v. Rümkers Dickkopf, Picardie, Atle, Kota, Sully, Ceres, Little Club, Van Hoek, Thew, Reward, Vilmorin 29, Renfrew, and Florence × Aurore.

Although no direct evidence is forthcoming that the stunting phenomenon results from infection by *U. tritici*, the existence of a correlation may safely be assumed on the grounds of (*a*) the high degree of specificity referred to above, and (*b*) the development in certain varieties, e.g., Ceres, of small, smutted ears, especially after inoculation with collection C (race 1) from Van Hoek. Hypersensitiveness of such a severe degree appears to be almost unprecedented in the history of phytopathology, except possibly in the case of certain potato viruses [ibid., xviii, p. 756], though Thren's observations on physiologic specialization in barley loose smut (*U. nuda*) described in *Phytopath. Z.*, xiii, pp. 539–571, 1941, may be considered to point in the same direction.

Two different principles are evidently involved in the relationship of host to parasite, namely, (1) susceptibility or non-susceptibility, determining whether the plant will be attacked, and if so, to what extent, and (2) hypersensitiveness or non-hypersensitiveness, determining whether the host will show the hypersensitive reaction or produce smutted ears: plants are, therefore, either (1) resistant, (2) susceptible and non-hypersensitive, or (3) susceptible and hypersensitive. For practical purposes the term 'hypersensitive' may be replaced by 'field-resistant'. Proof of this hypothesis is afforded by the facts that (1) races 1 and 3 induce hypersensitiveness in certain varietal groups which react to 2 and 4 by susceptibility only; (2) the incidence of infection, generally speaking, is the same for all six races, irrespective of whether the varieties react with susceptibility or with hypersensitiveness; and (3) the temperature prevailing during the ripening of the seed exerts a strong influence on the extent both of hypersensitiveness and susceptibility (of which only the former is discussed in this paper); in Fylgia inoculated with the Van Hoek isolate (race 1), for instance, the incidence of hypersensitiveness was about three times as high at 24° as at 13° C.

An attempt was made to explain the different varietal reactions on the basis of genetic factors. Two sets of specific factors for resistance, S_1S_1 and S_2S_2 in the

plant are assumed to interfere with complementary sets of factors in the parasite $\Sigma_1 \Sigma_1$ and $\Sigma_2 \Sigma_2$. A variety is resistant when a set of *S*-factors coincides with a corresponding one of Σ factors, i.e., $S_1 S_1 + \Sigma_1 \Sigma_1$ or $S_2 S_2 + \Sigma_2 \Sigma_2$: in all other cases it is susceptible. Sets of specific factors for hypersensitiveness must also be assumed both in the plant ($G_1 G_1$ and $G_2 G_2$) and pathogen ($\Gamma_1 \Gamma_1$ and $\Gamma_2 \Gamma_2$). A variety is hypersensitive when a set of *G*-factors corresponds with one of Γ-factors, i.e., $G_1 G_1 + \Gamma_1 \Gamma_1$ and $G_2 G_2 + \Gamma_2 \Gamma_2$.

LIVINGSTON (J. E.). **Important diseases of Corn in Nebraska.**—*Ext. Circ. Neb. Coll. Agric.* 1804, 8 pp., 7 col. figs., 1945.

Notes are given on the symptoms and control of the following maize diseases in Nebraska; dry rot (*Diplodia zeae*), pink rot (*Gibberella fujikuroi*), ear rot (*G. zeae*), cob rot (*Nigrospora sphaerica*), *Diplodia* stalk rot (*D. zeae*), charcoal root and stalk rot (*Macrophomina phaseoli*), and smut (*Ustilago maydis*).

SMITH (C. O.) & KLOTZ (L. J.). **A more virulent black pit organism on Citrus.**—*Phytopathology*, xxxv, 11, pp. 942–943, 1 fig., 1945.

A similar account of this work on black pit of Citrus caused by *Phytomonas* [*Pseudomonas*] *syringae* has already been noticed from another source [*R.A.M.*, xxiv, p. 446].

SCHULTZ (E. F.). **Algunas observaciones sobre la podredumbre de las racillas del Naranjo agrio injertado.** [Some observations on the root rot of the grafted bitter Orange.]—*Bol. Estac. exp. agríc. Tucumán* 54, 22 pp., 8 figs., 1945.

The available information concerning bitter orange root rot ('tristeza') [*R.A.M.*, xxv, p. 111] is fully summarized and discussed, with special reference to its occurrence in the provinces of Tucumán, Salta, and Jujuy, Argentina.

THIRUMALACHAR (M. J.). **Bud rot of Areca Palms in Mysore.**—*Nature, Lond.*, clvii, 3978, pp. 106–107, 1946.

Detailed microscopic examination of the affected parts of *Areca* palms in Mysore showing the condition known locally as 'hidimundige' [*R.A.M.*, xvii, p. 295] or thinning-out of the crown, in which the leaves are gradually shed and the entire crown slips out, revealed the presence of such large numbers of an unidentified species of *Aphelenchus*, that the parasitism of the nematode was beyond doubt. In a general way the organism resembled *A. cocophilus*, the cause of coconut red ring in the West Indies [ibid., iv, p. 724; ix, p. 714].

NOTINI (G.), MATHLEIN (R.), & LIHNELL (D.). **Grönmykos förorsakad av Metarrhizium anisopliae (Metsch.) Sorok. I. Grönmykosen som biologiskt insektbekämpningsmedel. II. Fysiologiska undersökningar över grönmykosens svamp.** [Green mycosis caused by *Metarrhizium anisopliae* (Metsch.) Sorok. I. Green mycoses as a biological means of insect control. II. Physiological investigations on the green mycosis fungus.]—*Medd. Växtskyddsanst., Stockh.*, 43, 90 pp., 23 figs., 1 diag., 7 graphs, 1944. [English summaries.]

Part I of this study is contributed by G. Notini and R. Mathlein and part II by D. Lihnell. That conidial germination in *Metarrhizium anisopliae* [*R.A.M.*, xxii, p. 96] is initiated by a stimulus from the fat layer of the chitinous integument of insects was demonstrated by the results of staining and other tests. Hyphal penetration through the chitin is effected with the aid of chitinase, the rate of the process being influenced by the structure and age of the chitin and the activity of the leucocytes below the mother cells of the integument. Hyphal development within the host is characterized by a pronounced affinity for the adipose tissue.

Mortality among insects parasitized by *M. anisopliae* is attributable to the toxic properties of the hyphae.

The following pests were more or less effectively combated in inoculation tests of varying extent with the muscadine fungus: *Sphinx pinastri*, *Dasychira pudibunda*, *Lymantria dispar*, *Agrotis segetum*, *A. nigricans*, *A. tritici*, *Rhyacia pronuba*, *Barathra brassicae*, *Polia oleracea*, *P. pisi*, *Cerapteryx graminis*, *Galleria mellonella*, *Ephestia kühniella*, *Tortrix paleana*, *T. viridana*, *Cossus cossus*, *Tinea secalella*, *Blastodacna putripennella*, *Hoffmanophila pseudospretella*, *Argyresthia conjugella*, *Contarinia tritici*, *C. pyrivora*, *C. leguminicola*, *Melolontha hippocastani*, and *Serica brunnea*. As regards the grain-moth (*T. secalella*) trials, further investigations are requisite to determine the practical utility of this mode of control, but the 40 per cent. mortality in a warehouse in which the walls, floor, &c., were sprayed with water and then dusted with conidia, is regarded as fairly promising for a preliminary test. Eleven other species were moderately susceptible to *M. anisopliae*, while a number of other insects tested proved to be immune.

The outlook for the practical application of the muscadine fungus to the extermination of susceptible insect pests is considered to be favourable for the following reasons. Inoculum is easily prepared in bulk from the conidia and disseminated either as an aqueous suspension with the admixture of 0·5 per cent. soft soap or in combination with dry inert fillers, e.g., fine silt, sand, diatomaceous earth, and talc; the conidia are capable of withstanding intense cold and abrupt temperature fluctuations; and the fungus is a well-marked facultative parasite, able to adjust itself to a saprophytic mode of existence.

The influence of the hydrogen-ion concentration of the medium on *M. anisopliae* was studied in a series of buffer nutrient solutions with α-alanin as a source of nitrogen. The mycelial growth curves were fairly level, with a slight peak round about P_H 7, these observations being confirmed in the main by estimates of the dry weight. Conidial production took place in all the cultures at and upwards of P_H 4. The minimum, optimum, and maximum temperatures for the development of the fungus on malt agar were 10°, 25° to 30°, and 32° to 34° C., respectively, conidia being formed throughout the range from 15° to 32° in quantities corresponding to the luxuriance of the mycelium.

About 30 sources of carbon, including the purified chitin of *Cossus cossus* and *Melolontha hippocastani*, were tested for their acceptability to *Metarrhizium anisopliae*. Glucose, sucrose, glycerol, peptone, and gelatine were most extensively utilized. Asparagin was a superior source of nitrogen to ammonium nitrate in the promotion of conidial production, but α-alanin, urea, peptone, and gelatine also provided an active stimulus to growth, particularly the series in which carbon was furnished by glycerine in place of glucose. Although *M. anisopliae* is autotrophic on a purely synthetic nutrient solution, the addition of a small amount (0·2 per cent.) of yeast extract resulted in modest but definite increases in mycelial weight and conidial production. On the other hand, a dilute extract of body fluid from *C. cossus* larvae exerted a stimulus comparable to that afforded by yeast extract.

Van Slogteren (E.) & De Bruyn Ouboter (Maria P.). **Onderzoekingen over virus-ziekten in bloembolgewassen. I. Narcissen. I.** [Studies on virus diseases in flowering bulb crops. I. Narcissi. I.]—*Meded. LandbHoogesch., Wageningen*, xlv, 3, 32 pp., 31 figs. (4 col.), 1 diag., 1941. [German summary.]

The following are among the conclusions drawn from the author's extensive studies, covering a period of four years, on some outstanding problems in connexion with the narcissus mosaic virus on daffodils (*Narcissus* [*pseudo-narcissus*]) and other narcissi in Holland [*R.A.M.*, xix, p. 21]. Artificial infection experiments are more successful when undertaken early in the season. In 1937, for instance, 84 Sir

Watkin daffodil plants were inoculated with juice from diseased individuals of the same variety on eight different dates between 3rd March and 2nd June, inclusive, and in 1938 the resulting percentages of infection on the 27 reacting positively were 20, 46·6, 50, 26·6, and 80 for the series of 18th and 31st March and 8th, 14th, and 22nd April, while negative results were obtained in those of 3rd March, 29th April, and 2nd June. None of the 400 controls developed any symptoms. In another series of tests on 352 daffodils covering a longer period (23rd and 24th March to 13th and 14th July) in 1939–40, 100 per cent. infection developed in the plants inoculated on 13th April, the corresponding figures for 23rd, 24th, and 31st March, 7th, 8th, 21st and 28th April, 3rd, 9th, 16th, 18th and 19th, and 24th and 26th May, 31st May and 1st June, and 7th and 8th June being 95, 70, 85, 30, 30, 20, 40, 30, 5, 5, and 5, respectively, while from 12th and 13th June to 12th and 13th July only negative results were secured. The 31st March, 21st and 28th April, and 16th, 18th, and 19th May series of tests further yielded 20, 20, 5, and 5 per cent. doubtfully positive results, respectively. The 193 controls planted in the same field remained completely healthy, as also did the mother batch of some 18,000 plants from which the test specimens were taken.

In another trial young field plants of Sir Watkin were inoculated on 8th and 9th, 14th and 15th, 23rd and 31st March, and 5th and 12th April, 1939, with juice from dried plants in varying stages of maturity from the end of flowering to the dying-off of the foliage, with 90, 100, 50, 83·3, 100, and 20 per cent. positive results, respectively, the 23rd and 31st March tests also eliciting 6·25 and 8·3 per cent. doubtful responses, respectively. From the combined outcome of this and the foregoing experiment it may be inferred that the stage of growth of the host is a more important factor in the success of inoculation tests than that of the plant providing the inoculum.

Other tests were carried out to determine the influence on the development of mosaic of the amount of infective material introduced into the host. Thus, on 22nd April, 1937, 8 to 10 leaves of each of ten plants were inoculated in one lot, and all those of another ten, with resultant positive percentages in 1938 of 20 and 80, respectively. Again, between 17th April and 22nd May, 1939, three leaves of each of 52 plants were inoculated in one batch and all those of another 52, the positive percentages in 1940 being 7·7 and 37·7, respectively, with 1·7 doubtful in the latter.

McWhorter inclined to the opinion that infection was spread by means of root contact [ibid., xi, p. 579], but the writer's experiments do not support this view. Thus in 1938, 25 diseased and 25 sound bulbs of the Mrs. A. Krelage variety were arranged in three plots permitting of (A) contact both under and above ground, (B) above ground only, and (C) underground only, with resultant percentages of diseased plants in 1939 of 24, 20 (and 4 doubtful), and 0 (and 4 doubtful), respectively. A similar test was carried out with twice the number of Sir Watkins in 1939, in which the positive percentages in 1940 in plots (A), (B), and (C) were 16 (and 2 doubtful), 6 (and 2 doubtful), and 0, respectively. The fact that plants grown in frames under conditions precluding insect infestation remained healthy, whereas those exposed to this danger in the field contracted severe infection, was considered to point to the implication of an aphid in the transmission of the virus, and a footnote states that proof has since been obtained of the great activity in this respect of *Aulacorthum* [*Macrosiphum*] *solani* and of the lesser part played in the spread of mosaic by *Doralis* [*Aphis*] *fabae* and *M. euphorbiae* [*M. solanifolii*; cf. ibid., xx, p. 206].

Another experiment was undertaken to determine the influence of proximity to diseased plants on the development of mosaic in healthy ones with the following results. Of 116 Minister Talma bulbs surrounded by healthy neighbours, 5·2 per cent. became diseased, compared with 12·7 per cent. of the same number interplanted with at least one infected individual. No infection developed in two lots

of Sir Watkin adjacent to diseased plants, while in three of Dubbel van Sion the resulting mosaic percentages were as follows: of 3,330 interplanted with sound bulbs, 1·8, and of 970 with at least one sick neighbour, 7·2; of 138 with the adjacent bulbs all sound, 0; and of 70 with at least one diseased in the vicinity, 4·3; of 116 planted near healthy bulbs, 9·4, and of 112 in proximity to many diseased ones, 36. In conjunction with this test, the effect of the date of lifting the bulbs on the spread of the virus was investigated. Of 100 Sir Watkins selected as healthy in the spring of 1936, surrounded by virus-free neighbours and lifted early, none of the 205 bulbs planted in the autumn gave rise to diseased plants in 1937, compared with 1·4 per cent. infection in the progeny of 217, also originating from healthy plants with sound neighbours but dug at the normal time. In another batch of Sir Watkins, 174 bulbs from 100 healthy plants surrounded by many diseased ones and lifted early produced 3 per cent. mosaic offspring, the corresponding figure for 188 bulbs from 100 sound plants with diseased neighbours dug at the normal time being 13. In another test 1,055 bulbs planted in the autumn of 1938 from 500 Sir Watkins selected as healthy in the previous spring, surrounded by numerous infected plants and lifted early (22nd June), gave rise to 40·6 per cent. diseased progeny, while the corresponding figure for 1,072 bulbs from 500 healthy plants intermingled with diseased ones and dug at the normal time (28th July) was 50·9.

From a table giving the results of intervarietal cross-inoculation experiments on a number of well-known daffodils, and the figures illustrating the symptoms thus induced, it is evident that a single virus may be responsible for a great diversity of pathological manifestations. Hence it is concluded that the reaction to infection is an attribute of the individual plant and not of the host providing the inoculum. Further weight was lent to this hypothesis by the outcome of serological experiments.

Various symptom complexes are described and figured, which are presumably of virus origin, but have not yet been positively determined by inoculation experiments.

Control should consist in the timely inspection (at the opening of the growing season) of all daffodil fields and the prompt removal of all plants suspected of harbouring the mosaic virus.

McClellan (W. D.). **Pathogenicity of the vascular Fusarium of Gladiolus to some additional Iridaceous plants.**—*Phytopathology*, xxxv, 11, pp. 921–930, 3 figs., 1945.

A full account is given of inoculation experiments demonstrating the pathogenicity of *Fusarium orthoceras* var. *gladioli* [*R.A.M.*, xxiii, p. 345] to *Babiana* hybrids, mixed spring-flowering *Crocus*, *Freesia* seedlings, *Homeria collina*, bulbous *Iris* of the Imperator, Poggenboek, and Wedgewood varieties, *Ixia* hybrids (Bloem Erf, Dutch, and Mrs. Cleveland's), assorted *Sparaxis*, *Streptanthera cuprea*, *Tritonia crocata* seedlings, and assorted *Watsonia*. A fungus similar to *F. orthoceras* var. *gladioli* isolated from *Iris* was innocuous to the Picardy and Dr. F. E. Bennett *Gladiolus* varieties.

Rosen (H. R.). **Search for black-spot resistance in Roses.**—*Amer. Rose Annu., 1944*, pp. 155–159, 1944.

This is a report of the progress to date in the development of resistance to rose black spot [*Diplocarpon rosae*] in the United States [see next abstracts]. A definite landmark in breeding for this purpose is represented by the everblooming bush variety Pink Princess, produced by Brownells from a cross between (Dr. W. van Fleet × Gen. Jacqueminot) × Break o' Day, the latter a hybrid of Seedling × Glenn Dale. The new variety appears to be the first to possess true resistance to the fungus, as opposed to mere escape from infection under the influence of favourable climatic and environmental conditions.

SMITH (A. G.). **Lime and fertilizers in relation to blackspot of Roses.**—*Bull. Va agric. Exp. Sta.* 368, 10 pp., 1945.

Following the claim made by C. Mallerin (*Annu. Amer. Rose Soc.*, xxiii, pp. 149–152, 1938) that he had controlled rose black spot (*Diplocarpon rosae*) [*R.A.M.*, xxiv, p. 103] through using a fertilizer containing nitrogen, phosphoric acid, and potash in a ratio of 1 : 2·5 : 3·5 (i.e., 36, 90, and 126 lb. per acre) together with fungicidal sprays, an experiment was begun in 1937 at Blacksburg, Virginia, in which Mallerin's fertilizer mixture was used as a basis of study, with potash treatments below and above this level, Mallerin having attributed his success mainly to the amount of potash applied. As most of the plots gave a P_H reading much below the figure (7·5) recommended by Mallerin, lime was added to two series to raise the P_H one unit, while in two others this amount was doubled.

The data obtained showed that lime had no effect on the number of leaves infected with black spot. In 1939 and again in 1940 there was no significant difference in the number of affected leaves between the plots receiving Mallerin's fertilizer and those on which a different fertilizer mixture was used. In 1941 (the most abnormal season for roses in six years, locally), there was a significant reduction in the number of black-spot leaves in the plots where a fertilizer high in potash was used, but the reason for this is not clear. On the other hand, there was a significant difference in varietal behaviour towards the disease, Étoile de Hollande (with 16·4 per cent. of the leaves infected) being most resistant, followed in descending order by Dickson's Red, McGredy's Sunset, World's Fair, Rome Glory, and Alice Harding (44 per cent.).

It is concluded that the degree of resistance to black spot shown by a given rose variety appears to be a more important factor in control than an excessive use of potash as a fertilizer.

LYLE (E. W.). **Understocks and black-spot. Four Rose understocks and their effect on the occurrence of black-spot and growth of bushes.**—*Amer. Rose Annu., 1944*, pp. 160–162, 1944.

The effects of four kinds of understocks on the development of rose black spot (*Diplocarpon rosae*) [see preceding abstracts] in susceptible Caledonia scions were observed at the Texas Agricultural Experiment Station [*R.A.M.*, xxiv, p. 104]. Budding was effected between 18th July and 29th August, 1941, and the understock tops were cut off on 17th March, 1942. On 5th May following, the percentages of diseased plants on Welch Multiflora, Tate Multiflora, *Rosa manetti*, and Texas Wax were 20·7, 36·7, 76·5, and 36·5, respectively, and the percentages of spotted leaflets on 28th July 25·7, 21·8, 24·5, and 21·2, respectively. Despite the general increase in black spot with the advance of the season, there were significant differences at harvest time in favour of the two Multiflora stocks as regards the size and quality of the bushes. The weekly application of sulphur-copper dust increased the percentage of bushes grading No. 1½ and upwards from 52 to 89, and the weight per ten bushes from 2·29 to 3·62 lb.

MUNRO (MOIRA C. D.). **A root rot of Cineraria and a study of the species of Phytophthora concerned.**—*Trans. Brit. mycol. Soc.*, xxviii, 3–4, pp. 115–126, 1945.

Cinerarias grown as pot plants in Ayrshire nurseries suffer from a root rot and wilt, affecting plants at all stages of growth but especially seedlings and plants just ready to flower. The first symptom is a tendency to wilt, which appears suddenly, the lower leaves being affected first, although still retaining their green colour; later the young leaves droop. In severe attacks shading and watering failed

to produce any recovery. Wilted plants showed a pinkish discoloration of the roots which in advanced stages were brown, exhibiting a soft, odourless rot. The cortex sloughed easily on pulling the root from the soil and rotting of the xylem and pith was frequently present in the crown.

Fungi isolated from roots showing pinkish discoloration of the stele included *Fusarium* and *Ascochyta* spp., but usually the only growth was a Phycomycetous fungus resembling *Pythium* or *Phytophthora*; the presence in some cases of amphigynous oogonia, and the tendency to release zoospores directly from the sporangium with no external vesicle, suggested the latter genus. The ease and frequency of these *Phytophthora* isolations indicated that these isolates were the pathogens. Artificial inoculations of healthy plants produced 64 per cent. root-rot infection, the disease usually becoming apparent in four weeks. Roots from these plants again yielded *Phytophthora* cultures.

Detailed studies of the isolates resulted in most of them being identified as *P. cinnamomi*; inoculations with these isolates produced the most rapid rotting, and this species is believed to be responsible in the greatest measure for the disease. *P. cambivora* was also identified among the isolates, and though parasitic, was found to be much less virulent than *P. cinnamomi*.

Hughes (S. J.). **Studies on some diseases of Sainfoin (Onobrychis sativa). I. Ring-spot caused by Pleospora herbarum (Pers.) Rabenh.**—*Trans. Brit. mycol. Soc.*, xxviii, 3–4, pp. 86–90, 1 pl., 3 figs., 1945.

Of 17 fungi listed by Oudemans (Enum. syst. fung., iii, p. 944, 1921) on sainfoin (*Onobrychis sativa*), only three induce disease in Britain, viz., leaf spot (*Ascochyta orobi*), rust (*Uromyces onobrychidis*), and mildew (*Erysiphe polygoni*). Two diseases not mentioned by Oudemans are chocolate spot (*Botrytis cinerea*), observed in Glamorgan to kill flower buds and cause a stem rot under very moist conditions, and rot caused by *Sclerotinia trifoliorum* [*R.A.M.*, xx, p. 72]. A leaf spot of sainfoin caused by *Ramularia onobrychidis* was found by the author in December, 1942.

Ring spot (*Pleospora herbarum*, stat. conid. *Stemphylium botryosum*) is always present throughout the year on sainfoin in Glamorgan and is most abundant in the spring; it was common at all stations in April, 1944. The spot consists of a circular, light brown area with a darker, well-defined margin. Young lesions are entirely dark brown but the central zone becomes lighter as infection spreads. Abundant conidia are produced in favourable conditions of moisture and give the spot a conspicuous sooty appearance. The fungus also thrives on dead leaves and sainfoin stems. Infected leaflets wither and fall, particularly in spring when the pathogen is most active, but generally speaking no significant loss is caused to crops. The spots closely resemble those caused by *A. orobi*.

Sainfoin leaves were sprayed with a suspension of conidia and loopfuls of an ascospore suspension were placed on the leaflets. In an atmosphere only slightly moist germ-tubes entered the leaf through the stomata, but it is possible that cuticular penetration also takes place. Once within the substomatal cavity, the hypha widens and soon branches out intracellularly through the leaf tissues [cf. ibid., xx, p. 306]. Hyphae penetrate the epidermal cells from below and finally make their way between the epidermal cells and cuticle. Proliferation occurs and subcuticular stromatic cushions are formed, from which develop tufts of conidiophores bearing conidia [ibid., xviii, p. 141].

Perithecia of *P. herbarum* were formed in monoconidial cultures exposed to light and were found on dead sainfoin stems in 1942 before any leaf-spotting was observed, their mean ascospore measurements being 34 by 16 μ in nature and 35 by 16 μ in culture, while conidial measurements were 36 by 17 μ in nature and 32 by 17 μ in culture.

Christoff [Khristov] (A.). Опредѣляне на жизнеспособностья чрезъ оцвѣтяване съ Nile blue sulfate. [Differential staining by the aid of the Nile blue sulphate.]—*Спис. Земед.-Опит. Инсти България.* [*J. agric. Exp. Stas Bulgaria*], xi, 4, pp. 13–15, 1941. [English summary. Received December, 1945.]

Differential staining of living and dead sclerotia of *Sclerotinia trifoliorum* has been obtained by soaking the cut sclerotia in 0·2 per cent. Nile blue sulphate in water for five minutes, washing or drying to remove excess stain, and then placing them in 0·025 per cent. potassium hydroxide. The dead sclerotia were stained blue or bluish-green, the living red. Similar differentiation also occurs in the mycelium of *S. trifoliorum*, as well as in mycelium and sclerotia of *S. sclerotiorum*. On the other hand, an opposite result was obtained with *Ophiobolus graminis*, the dead mycelium staining red and the living blue; in this case differentiation was carried out in 0·1 per cent. potassium hydroxide solution.

Strips obtained from the epidermis of tobacco and tomato plants infected with severe-etch virus showed that cells without chlorophyll became red, and the amorphous and crystalline virus inclusions blue.

Christoff [Khristov] (A.). Развитие и кълнение на склероцитѣ на Sclerotinia trifoliorum Erikkson. [Development and germination of *Sclerotinia trifoliorum* Eriksson.]—*Год. Унив. София, Агрон.-Лес. Фак.* [*Yearb. Univ. Sofia, Fac. Agric.*], xx, pp. 86–87, 3 figs., 1941–42. [English summary. Received December, 1945.]

In the course of these experiments, based on studies at Rothamsted in 1940, nitrates and urea (used at under 0·3 per cent.) were shown to promote the development of the sclerotia of *Sclerotinia trifoliorum* [*R.A.M.*, xviii, p. 628; xxiii, p. 22], contrary to Pape's findings [ibid., xvii, p. 252]. The viability of the sclerotia decreases with increased depth of burial in the soil and higher water content in the soil. Sclerotia submerged in water survived for 26 days and then decayed completely, but retained their germination capacity for 22 months when kept dry in the laboratory. Germination of the sclerotia was seen to depend on the composition of the media on which they developed, the degree of their maturity, soil texture, temperature, moisture, and reaction, and light. Light delays sclerotial development, but is indispensable to the development of the apothecia, and red, blue, and yellow light favoured germination. The optimum temperature for sclerotial germination was about 16° C., good results being obtained between 10° and 20°. Germination is satisfactory within a wide range of P_H, with the optimum on the alkaline side. Light, well-aerated soils are best for germination, but not at depths below 1 to 2 cm. [cf. ibid., xxv, p. 44]. Potassium sulphate favours germination, but other fertilizers, particularly urea, inhibit it, sometimes completely. Re-germination of mature sclerotia is possible under favourable conditions.

Thirumalachar (M. J.). **Ergot on Pennisetum hohenackeri Hochst.**—*Nature, Lond.*, clvi, 3973, p. 754, 1945.

The ergot and sphacelial stages of a species of *Claviceps* were collected on *Pennisetum hohenackeri* [cf. *R.A.M.*, xxv, p. 36] near Bangalore in February and March, 1945. Mature sclerotia germinated in sterilized moist sand after 20 to 30 days, the first indication being the rupture of the cortex and the extrusion of a white, globose head. When mature the ascigerous head was maroon-red with a pinkish tinge, 1 to 1·5 mm. in diameter, and with a papillate surface owing to the protrusion of the apices of the ostioles; the stipe, which was pure white, measured about 20 mm. long and tended to turn and twist. The colour of the stroma, and the size of the perithecia and ascospores indicate that the species

comes nearest to, or is identical with, *C. microcephala* [ibid., xvi, p. 447; xvii, p. 269], regarded by Petch as a synonym of *C. purpurea*.

WALLIN (J. R.) & REDDY (C. S.). **A bacterial disease of Phleum pratense L.**—*Phytopathology*, xxxv, 11, pp. 937–939, 1 fig., 1945.

A bacterial streak of timothy (*Phleum pratense*), first observed in Wisconsin in 1925, was present in Iowa in 1940 and widespread in the Ames district of the State in 1941. The lesions ranged from barely perceptible marks to streaks upwards of 2 cm. in length on the leaf blades of the young shoots, and when prevalent resulted in the stunting of the plants. In the hay stage the flag leaves developed a conspicuous streaking on the blades and sheaths. In severe cases the emerging heads were sealed in the spiral whorl by bacterial exudate or malformed on emergence from the boot. Under warm, humid conditions, droplets of yellowish bacterial exudate, turning into hard, resinous granules on drying, were produced on the surface of the lesions as late as November. In its cultural and biochemical characters and symptomatology the pathogen agreed for the most part with *Xanthomonas translucens* on barley, brome grass [*Bromus* spp.], rye, and wheat, but on the grounds of its failure to infect these hosts in cross-inoculation tests it is classified as a new variety, var. *phleipratensis*.

CORKILL (L.) & ROSE (R. E.). **Observations on susceptibility of Perennial Rye-Grass to blind-seed disease.**—*N.Z.J. Sci. Tech.*, A, xxvii, 1, pp. 14–18, 1 fig., 1945.

In 1940–1, 241 perennial rye grass (*Lolium perenne*) plants were inoculated by Rose's technique [see next abstract] with the agent of blind-seed disease (*Phialea temulenta*), which in seasons favourable to the fungus renders the New Zealand seed crop practically valueless. The material comprised 65 plants from four old-pasture Southland lines previously shown by Gorman's field tests to have a fairly high germinative capacity [*R.A.M.*, xx, p. 263]; 129 selected from 15 certified lines of very low germination; and 47 of certified origin that had produced high germinating seed crops under heavy natural inoculation in the field. The mean percentage infection in the two groups of certified plants was 28·3 and in the Southland lines 7, the difference of 21·3 with a standard error of 9·2 being significant at the 1 per cent. level. The mean percentage infection of the clone used as a standard was 49·2 (standard error 4·49). In the following season 11 resistant plants were used in seven reciprocal crosses, and five susceptible in five, and 154 offspring of the former and 74 of the latter inoculated with *P. temulenta*, giving rise to 31·7 and 73·5 per cent. mean infection, respectively, compared with 91·1 per cent. for the standard. The mean difference of 41·8 per cent. (standard error 3·5) between the resistant and susceptible groups is highly significant and points to the heritable nature of susceptibility to the disease.

ROSE (R. E.). **A technique for the artificial inoculation of Perennial Rye-grass by the blind-seed organism.**—*N.Z. J. Sci. Tech.*, A, xxvii, 1, pp. 18–22, 1 graph, 1945.

Under the average climatic conditions prevailing in Palmerston North, New Zealand, during November and December, the high humidity and moderate temperature induced by the erection of a canopy of Hessian cloth over the propagation frames permits of heavy and uniform infection of susceptible perennial rye grass (*Lolium perenne*) plants by artificial inoculation with an aqueous suspension of the blind-seed fungus (*Phialea temulenta*) from Czapek-Dox cultures [see preceding abstract]. The plants are sprayed daily at 4.30 p.m. for about a week after the onset of flowering. To express the results of infection, 30 seeds are taken from each plant, each seed placed in a drop of water on a slide, the palea slightly

scratched with a needle, and microscopic examination made for the presence of conidia. Two classes of infection are differentiated, 'heavy' and 'light', and the percentage of 'effective infection' calculated on the basis of the former.

BENLLOCH (M.). **La viruela de las hojas de la Alfalfa Pseudopeziza medicaginis (Lib.) Sacc.** [Leaf spot of Lucerne, *Pseudopeziza medicaginis* (Lib.) Sacc.]—*Bol. Pat. veg. Ent. agríc., Madr.*, xiii, pp. 33–38, 4 figs., 1944.

Leaf spot of lucerne (*Pseudopeziza medicaginis*), already known from previous records to be widespread in Spain, was observed on a recent visit to Málaga to be causing heavy damage. The symptoms of the disease and the life-history of the causal organism are briefly described. The only practicable control measure is to expedite the cutting of the crop, which should take place before the leaves begin to fall or the apothecia responsible for the propagation of the fungus reach maturity.

Kräfta på frukträd. [Canker on fruit trees.]—*Flygbl. Växtskyddsanst., Stockh.*, 76, 4 pp., 1 fig., 1945.

In this revised edition of pamphlet No. 41 in the same series, originally published in 1938, notes are given on the symptoms of fruit tree canker (*Nectria galligena*), the environmental conditions favouring its occurrence, its economic importance, varietal reactions to the disease, and control measures. In Sweden the fungus principally attacks apples [*R.A.M.*, xxi, p. 24], the most susceptible varieties of which are Alexander, Cox's Orange, Cox's Pomona, Gravenstein, White Transparent, and Åkerö, while Beauty of Boskoop, Bismarck, Boiken, Charlamowsky, Filippa, Golden Noble, and Sävstaholm are comparatively resistant. Pears and other softwoods serve as occasional hosts of the fungus. A severe winter, preceded by a mild, damp autumn, and a heavy summer rainfall are conducive to heavy infection by *N. galligena*, which also flourishes on stiff, wet soils and in closely planted orchards.

DUNEGAN (J. C.) & ISELY (D.). **Leafhopper oviposition, the cause of one form of Apple measles.**—*Phytopathology*, xxxv, 11, pp. 870–876, 2 figs., 1945.

Evidence is presented in support of the view that the pustular type of apple measles, originally described by Hewitt and Truax (*Bull. Ark. agric. Exp. Sta.* 112, 1912), is caused by the deposition of leafhopper (*Typhlocyba pomaria*) eggs in the twigs. The disorder in question is considered to be quite distinct not only from the scurfy type of measles reported by these authors at the same time, but also from other obscure cortical abnormalities, such as Rose's rough bark or scurfy canker (*Phytopathology*, vii, pp. 198–208, 1917), Rhoads's isolated pustular, aggregate pustular, and canker forms [*R.A.M.*, iii, p. 722], Roberts's target canker [ibid., xiii, p. 384], Berg's black pox and internal necrosis [ibid., xiv, p. 372]; from the boron-deficiency manifestations investigated by Young and Winter [ibid., xvii, p. 400], Burrell (*Ext. Bull. Cornell agric. Exp. Sta.* 428, 1940), and Hildebrand (*Phytopathology*, xxix, p. 10, 1939); and from the adverse effect of high soluble-salt concentrations in the soil reported by Crawford from New Mexico [*R.A.M.*, xvii, p. 608].

HAMMARLUND (L.). **Sprøjtning af Æbletræer efter Fruktplukningen.** [Spraying of Apple trees after harvesting.]—Reprinted from *Gartnertidende, 1945*, 45, 1 p., 1945.

The apple scab fungus [*Venturia inaequalis*] overwinters in Denmark for the most part in the fallen leaves. Suppression of this source of reinfection is effected either by the burial or ploughing-under of the fallen leaves, a practice attended by considerable difficulty, or by spraying them with a fungicide, preferably towards the close of the dormant period. Of the various preparations tested against

the pathogen in laboratory experiments, ammonium sulphate and potassium sulphate appear likely to combine efficiency with economy (since they will serve simultaneously as fertilizers) in the orchard, but outdoor trials are necessary to confirm these observations.

WILKINSON (E. H.). **Observations on the perennial canker fungus, Gloeosporium perennans Zeller & Childs.**—*Trans. Brit. mycol. Soc.*, xxviii, 3–4, pp. 77–85, 1 pl., 3 figs., 1945.

In this paper the author reviews his researches into the perennial canker disease of apples (*Gloeosporium* [*Neofabraea*] *perennans*), already abstracted from other sources [*R.A.M.*, xxiv, p. 422]. In fruits the rate of decay is approximately the same as that produced by *G. album*, and much slower than in the case of *G. fructigenum*.

CHRISTOFF [KHRISTOV] (A.). Приносъ къмъ проучването на червенитѣ петна по Сливата—**Polystigma rubrum (Persoon) de Candolle. I.** Гостоприемници и устойчивость на сортоветѣ спрямо болестьта. [Plum red leaf spot disease —*Polystigma rubrum* (Persoon) de Candollė. I. Host relationships and varietal resistance.]—*Год. Земед.-Стоп. Изслед. и Опит. Инсти България.* [*Yearb. agric. Exp. Stas Bulgaria*], 1, pp. 63–69, 1943. [English summary. Received December, 1945.]

Red leaf spot disease [leaf scorch] of plum (*Polystigma rubrum*) [*R.A.M.*, xi, p. 660; xvi, p. 392] continues to occur with greater or less severity throughout Bulgaria, in some years causing partial or complete premature defoliation of the trees, progressively weakening them and inducing early death.

The author's researches from 1931 to 1943 showed, however, decided resistance on the part of *Crataegus*, almond, apricot, and wild cherry (*Prunus avium*), which exhibited no signs of attack even when planted among plum varieties severely affected by the disease. Up to 1943 the author had found *Polystigma rubrum* on *Prunus cerasifera*, plum, damson, *P. salicina*, and *P. spinosa*. There was great diversity in the susceptibility to the disease of varieties of these species and records compiled during the epiphytotic year 1941 showed that varieties of plum and damson varied in their susceptibility whilst those of *P. cerasifera* were either entirely or quasi-resistant. Yellow Afusca (*P. cerasifera*) was observed to be free from attack, Rivers Early, King, Montfort, Green Queen Claudia, and Schöne von Löwen plums were very slightly infected, Early Mirabelle damson and Bühler early plum slightly infected, and Küstendil, Ostava, Victoria, Anna Spät, and Italian plums were very susceptible, especially the two first-named.

TAYLOR (G. G.). **Experiments with spray treatments for control of diseases and pests of Raspberries.**—*N.Z.J. Sci. Tech.*, A, xxvii, 2, pp. 83–90, 1945.

In preliminary experiments in 1940–1 and 1941–2, and in a fuller series from 1942–3 to 1944–5 in Nelson Province, New Zealand, highly significant increases in raspberry yields and improvement in plant vigour were obtained by spraying with Bordeaux mixture and lead arsenate against two fungal diseases, cane spot (*Elsinoe veneta*) and leaf spot (*Septoria* [*Mycosphaerella*] *rubi*), and bud moth (*Carposina adreptella*). In 1943–4 the yield of sprayed Red Antwerps and Lloyd Georges amounted to 48·6 cwt. per acre compared with 38·9 for the untreated controls, the corresponding figures for 1944–5 being 43·9 and 29·5, respectively.

SUIT (R. F.) & PALMITER (D. H.). **Control of Gooseberry diseases.**—*Bull. N.Y. St. agric. Exp. Sta.* 711, 22 pp., 7 figs., 1945.

A full account is given of experiments carried out in New York State from 1937 to 1944, inclusive, on the control of the three most important gooseberry diseases that occur locally, viz., powdery mildew (*Sphaerotheca mors-uvae*) [*R.A.M.*, xxiv,

pp. 193, 456], leaf spot (*Mycosphaerella grossulariae* and *Pseudopeziza ribis*) [ibid., xxiii, p. 327], and rust (*Puccinia grossulariae*) [*P. pringsheimiana*: ibid., xix, p. 200; xx, p. 72]. Of these, powdery mildew and leaf spot are general throughout the State, while rust is found in the Hudson Valley area. All the work was done on the large-fruited, English type of gooseberries, which are very susceptible to these diseases, and mostly on the Cautauqua variety. Powdery mildew seldom attacks the American types, though leaf spot and rust may produce defoliation.

The results showed that the best control of powdery mildew was given by one application immediately after bloom of lime-sulphur 2–100 plus ½ lb. spraysay A. The most important factor in the control of this disease was the timing of the spray, which must be applied as soon as the fruit has set; a delay of only one week will considerably increase the amount of mildew on the fruit. Copper fungicides were ineffective against powdery mildew during a dry season.

Against leaf spot the best control followed two applications of Bordeaux mixture (3–5–100) plus one pint S.E.C. oil, the first made about 1st June, when the disease was first noticed, and the second in July, immediately after picking. Lime-sulphur did not give control.

The simplest and most economical way to control rust, which is generally regarded as of small importance, because many holdings are unaffected, but which can present a major problem in plantings near the alternate sedge [*Carex*] host, was found to consist in eradicating the alternate host. The sedge plants were removed or burned in the late autumn or early spring. In cases where the sedge could not be removed three applications of lime-sulphur (2–100) at the green-tip stage, about 10 days later, and just before bloom gave perfect control.

Wilcox (R. B.). **Further tests of organic fungicides for control of Cranberry fruit rot.**—*Proc. Amer. Cranberry Grs' Ass.*, lxxv, pp. 16–22, 1945. [Abs. in *Exp. Sta. Rec.*, xciv, 1, p. 78, 1946.]

As in previous trials [in Massachusetts], fermate gave much better control of cranberry fruit rot [*Glomerella cingulata* var. *vaccinii* and other fungi: *R.A.M.*, xxiv, p. 458] than Bordeaux mixture, dithane A–10 was about equally effective while dithane B–11 satisfactorily combated field and early storage decays but was inferior to fermate against those occurring in the later stages of keeping, which were in general the most refractory. The 2–100 formula of fermate would appear to suffice for all ordinary purposes, but 3–100 may be used where severe infection or protracted storage is anticipated and 1–100 should be adequate for mild attacks.

Benlloch (M.). **Notas de patología olivarera en 1944.** [Notes on the pathology of the Olive in 1944.]—*Bol. Pat. veg. Ent. agríc., Madr.*, xiii, pp. 141–148, 6 figs., 1944.

The epidemic of olive knot (*Bacterium* [*Pseudomonas*] *savastanoi*) [*R.A.M.*, xxiv, p. 24] in Badajoz in 1944 was the worst within the writer's experience, having been aggravated by damage from cold and frost. Not only were the young branches attacked, but the main veins of the leaves and the petioles were also largely involved and the defoliation thereby increased.

A disease known as 'elongation', associated with decay of the trunk and main branches, is believed to be primarily of physiological origin, the only fungus (? *Acremoniella* sp.) encountered in the root system being too limited in scope to produce the serious aerial symptoms. The exposed roots of a certain number of trees in various localities were treated in February with copper oxychloride by Urquijo's method [ibid., xxi, p. 475] for chestnut ink disease [*Phytophthora cambivora*] control [cf. above, p. 153] followed by the application to the soil in the surrounding trench of ground copper sulphate at a dosage of 300 to 500 gm. per trunk. In the following September all the treated trees showed signs of improvement, but no definite opinion could be formed at this early stage as to the lasting efficacy of the method.

A new disease observed in the autumn in the province of Barcelona was characterized by foliar chlorosis, the leaves turning first yellow and then brown or snuff-coloured, and finally dying, and a varying number of necrotic areas in the cortex of the branches, which progressed from the tips downwards and contributed to dessication, especially of young trees. The roots did not appear to be affected. The examination of diseased material in the laboratory revealed no parasitic agency. A similar trouble in Italy has been attributed to a virus or boron deficiency and experiments are planned to ascertain whether these factors are implicated in Spain.

Il Centro di Studi sugli Anticrittogamici presso il R. Laboratorio Crittogamico e il R. Osservatorio Fitopatologico annessi all' Università di Pavia. [The Centre of Studies on Fungicides at the Royal Cryptogamic Laboratory and the Royal Phytopathological Observatory annexed to the University of Pavia.]—8 pp., 4 figs., Pavia, Premiata Tipografia Succ. Fusi, [1945].

In this leaflet an account is given of the methods used in testing fungicides at the Centre of Studies on Fungicides, attached to Pavia University, which was established in 1942, with R. Ciferri as Director and E. Baldacci as Assistant Director. The points dealt with cover *in vitro* and *in vivo* toxicity tests, tests of adhesiveness and 'residual fungicidal activity' (e.g., after rain), of emulsibility and wettability, of the ionic dissociation of active metals, of the dosage of metal the fungus can absorb, of scorching properties, and of the visibility of the deposit, and various subsidiary chemical studies.

Pollacci (G.) & Gallotti (M.). **Un nuovo anticrittogamico a base di mercurio.** [A new mercury fungicide.]—*Atti Ist. bot. Univ. Pavia*, Ser. iv^{a}, xiii, pp. 159–162, 1941. [Received February, 1946.]

Laboratory tests with a preparation containing sulphur proteinate of mercury [cf. *R.A.M.*, xviii, p. 781] are described. The substance inhibited the germination of *Alternaria tenuis* but gave conflicting results as a substitute for copper against *Plasmopara viticola*.

Pollacci (G.) & Gallotti (M.). **Un nuovo fitofarmaco a base di cloro.** [A new chlorine fungicide.]—*Atti Ist. bot. Univ. Pavia*, Ser. iv^{a}, xiii, pp. 171–173, 1941. [Received February, 1946.]

After stating that tests with various fungicides demonstrated that the spores of *Alternaria tenuis* are seven to eight times as resistant to these materials as are those of *Plasmopara* [*viticola*], the authors briefly describe the results of experiments made on *A. tenuis* with a new fungicide, 'ampelio C', which is stated to have given highly promising results in laboratory tests. It is made by dissolving 1 to 2 kg. solid calcium hypochlorite (20 to 25 per cent. active chlorine) and 15 gm. potassium bichromate in 100 l. water, and adding 1 to 2 kg. carbonate of lime. The quantities of the ingredients used vary with the parasite and the host. The amounts given above are intended for use against fungal diseases and insect pests of vine. The product is also prepared in dust form.

Christoff [Khristov] (A.). Възможности за предпазването на пръскачкитѣ и другитѣ метални съоръжения отъ разяждащото действие на разтворитѣ употрѣбявани при борбата съ болеститѣ въ градинарството. [The protection of orchard sprayers and other equipment from the corrosive action of solutions used in the control of horticultural diseases.]—*Год. Земед.-Стоп. Излед. Опит. Инсти България* [*Yearb. Agric. Exp. Stas Bulgaria*], i, pp. 71–86, 1943. [English summary. Received December, 1945.]

The author gives a fully tabulated account of an investigation on the means of

protecting sprayers and other equipment from damage by solutions of mercuric chloride, sulphuric acid, or copper sulphate. Wooden vessels are preferable to metal ones and the possible use of concrete vessels is suggested for large scale application of solutions having non-acid reactions. Lard and witch elm tar proved satisfactory against sulphuric acid and lime-sulphate solutions, but were quite ineffective against mercuric chloride. Beeswax, paraffin wax (m.p. 55–57°C.), or asphalt and paraffin wax mixed in equal parts gave the best protection against all products. Pine resin, shellac, and coppalac resin varnishes gave good protection against lime-sulphur and were useful against corrosive sublimate. Ten per cent. celluloid solution in acetone and 20 per cent. asphalt solution in xylol gave excellent results, but their poor adhesiveness in some cases is a disadvantage. Concrete vessels dressed with asphalt or wax are suitable for all solutions.

SCOTT WATSON (J. A.). **N.A.A.S.**—*J. Minist. Agric.*, lii, 10, pp. 469–471, 1946.

A brief account is given of the National Agricultural Advisory Service, to be established by the Ministry of Agriculture as from 1st October, 1946, in accordance with the recommendations of the Luxmoore Committee for the reorganization of advisory work. General advisers will be in close contact with individual farmers, while in each county or at the headquarters of the agricultural province specialists are to be stationed. These will maintain close touch with the Research Institutes and keep the general advisers supplied with new knowledge, assist them in difficult cases, and carry out field tests of new methods and machinery. The service is being organized and will be operated under the guidance of the Agricultural Improvement Council.

WHITEHOUSE (H. L. K.) & HALDANE (J. B. S.). **Symmetrical and asymmetrical reduction in Ascomycetes.**—*J. Genet.*, xlvii, 2, pp. 208–212, 1946.

In studies on *Neurospora sitophila* and *Bombardia lunata* asymmetrical post-reduction was found to be more frequent than symmetrical, i.e., when a pair of allelomorphs A and a segregate, the orders Aa Aa and aA aA are commoner than AaaA and aAAa. This does not obtain with *N. crassa*. Previous work had already shown that the frequency of pre-reduction (AAaa and aaAA) is variable.

RAMSBOTTOM (J.). **Poisonous fungi.**—31 pp., 15 col. pl., 3 figs., Penguin Books, Ltd., 1945. 2*s.*

This is an attractively illustrated, popularly written account of 25 poisonous fungi, comprising chiefly Agaricales. It forms a companion volume to the author's similar account of edible fungi [*R.A.M.*, xxxiii, p. 493].

GÄUMANN (E.). **Pflanzliche Infektionslehre.** [Plant infection instruction.]—611 pp., 8 diags., 119 graphs, 1 map, Basel, Verlag Birkhäuser, 1945. Paper covers S. Fr. 44.50, bound S. Fr. 48.50.

This treatise is described in the author's foreword as an introduction to some of the biological problems underlying sickness and an amplification, on the theoretical side, of phytopathological instruction. It does not profess to cover the field of specialized plant pathology or to add to the knowledge of individual diseases, but seeks rather to represent general parasitological and epidemiological ideas by means of selected examples, and to paraphrase the associated technical terms (many originating in human medicine) in such a way as to adapt them to phytopathological use. The six chapters deal with (1) infection, (2) infection concatenations, (3) parasitic adaptation of the pathogen, (4) predisposition of the host to disease, (5) disease, and (6) control of infectious plant diseases [cf. *R.A.M.*, xxv, pp. 5, 76].

Titus (A. C.). **Fungus growths and electric apparatus.**—*Gen. elect. Rev.*, xlv, 8, pp. 19–22, 8 figs., 1945.

The damage caused on various kinds of electrical equipment by fungi [*R.A.M.*, xxiv, p. 379], particularly *Aspergillus niger* and *Chaetomium globosum*, is described and the difficulties of combating the trouble discussed. The moulds flourish under so-called 'tropical' conditions, which are, however, not necessarily confined to tropical countries but exist wherever relative humidities of 85 per cent. and upwards are combined with temperatures of 25° to 35° C., e.g., in an unventilated moisture-proof packing-case on a loading platform in Nebraska during a dry period. The high operating temperatures of certain apparatus necessitate a strong degree of resistance to heat in any fungicide intended for incorporation in the coating material (varnish or lacquer): the limits of efficacy of the three usual preparations, viz., phenyl mercuric salicylate, pentachlorophenol, and salicylanilide are 100°, 85°, and an intermediate point, respectively. The mercury vapour evolved through the decomposition of mercurials exerts an adverse effect on selenium rectifiers during non-operating periods, while fungicides of this nature are also liable to cause serious corrosion of aluminium. They and pentachlorophenol may further be a source of dermatitis or respiratory trouble among workers engaged in the manufacture of coatings.

O[ppermann] (R. H.). **Scientific fungus farm.**—*J. Franklin Inst.*, ccxxxix, 2, pp. 160–161, 1945.

A 'scientific fungus farm' has been established at the Schenectady [New York] Works Laboratory of the General Electric Company to facilitate research on the identity and control of the moulds responsible for damage to electrical war equipment [see preceding abstract].

Olson (J. C.) & Macy (H.). **Propionic acid, sodium propionate, and calcium propionate as inhibitors of mold growth. I. Observations on the use of propionate-treated parchment in inhibiting mold growth on the surface of butter.**—*J. Dairy Sci.*, xxviii, 9, pp. 701–710, 2 figs., 1945.

Parchment paper treated with 5 per cent. calcium propionate solution acidified to P_H 5·5 with lactic acid was equally effective in the inhibition of mould growth on unsalted butter at the Minnesota Agricultural Experiment Station with similar material treated in 10 per cent. of the unacidified solution, and more so in the improvement of the keeping quality of the product [*R.A.M.*, xxi, p. 80 *et passim*]. Both sodium and calcium propionate solutions were superior to a saturated solution of sodium chloride for the suppression of surface mould growth. Pre-storage of butter, wrapped in propionate-treated parchment, at 10° F. for up to three months did not interfere with subsequent protection against mould growth on transference to higher temperatures. Calcium propionate-impregnated parchment was effective only in the dry state. Heating the propionate solutions to 175° did not impair their efficacy.

Penicillium expansum was conspicuously more resistant to the inhibitory effect of calcium propionate than the other moulds used in the tests, viz., *Hormodendrum cladosporioides*, *Cladosporium* spp., *Stemphylium congestum*, and *Aspergillus niger*.

Westerdijk (Johanna). **Mycologie en industrie.** [Mycology and industry.]—*Fungus, Wageningen*, xv, 4, pp. 25–30, 4 figs., 1944. [Received January, 1946.]

Important developments in the field of technical mycology are surveyed and an interesting account given of its applications in industrial processes, including alcoholic fermentation, food yeast manufacture, cheese-ripening, and penicillin production.

KNIGHT (S. G.) & FRAZIER (W. C.). **The effect of Corn steep liquor ash on penicillin production.**—*Science*, N.S., cii, 2659, pp. 617–618, 1945.

Supplements of maize steep ash significantly increased penicillin production by *Penicillium chrysogenum* strains NRRL 1951-B25 and X1612 in a synthetic medium [*R.A.M.*, xxv, pp. 129, 130]. Both strains produced more penicillin in the synthetic medium supplemented with 500 mg. ash than in the usual medium containing maize steep liquor. The P_H of the fermentations was always in the range for maximum penicillin production in shaken flasks. There appeared to be no difference between mould growth in the synthetic medium and that in the synthetic medium supplemented with ash. In further experiments the addition of supplements of maize steep liquor ash to the usual fermentation medium gave a 30 to 45 per cent. increase in penicillin production by both strains. The data obtained indicate that minerals play an important part in penicillin production. Further investigations on this point are in progress.

FLOREY (SIR H. W.), JENNINGS (M. A.), GILLIVER (K.), & SANDERS (A. G.). **Mycophenolic acid, an antibiotic from Penicillium brevi-compactum.**—*Lancet*, ccl, 6385, pp. 44–46, 1946.

Mycophenolic acid, one of the metabolic products of *Penicillium brevi-compactum*, was experimentally shown to be responsible for the antibacterial activity of the mould already reported by Wilkins and Harris [*R.A.M.*, xxiii, p. 56]. The writers further ascertained that it is fungistatic or fungicidal to a number of human pathogens, besides being completely or partially inhibitory to the growth of various plant pathogens. Thus, *Corynebacterium michiganense* was inhibited at a dilution of 1 in 320,000, *C. sepedonicum* at 1 in 160,000, *Xanthomonas begoniae* at 1 in 10,000, *Stereum purpureum* 1 in 80,000, *Verticillium dahliae*, *Claviceps purpurea*, *Phytophthora erythroseptica*, and *Rhizoctonia crocorum* [*Helicobasidium purpureum*] each at 1 in 20,000, and *R.* [*Corticium*] *solani* and *Actinomyces scabies* each at 1 in 5,000.

NANDI (P.). **Antibacterial substances from moulds.**—*Sci. Cult.*, xi, 6, pp. 290–293, 2 graphs, 1945.

The optimum conditions necessary for the production of an antibacterial substance by a strain of *Penicillium citrinum* [*R.A.M.*, xxi, p. 344] isolated from garden soil at the Bose Research Institute, Calcutta, on Czapek-Dox medium modified in various ways are fully discussed, and the technique for routine experiments of its potency against *Staphylococcus aureus* described.

BIRKINSHAW (J. H.), BRACKEN (A.), & RAISTRICK (H.). **Studies in the biochemistry of microorganisms. 73. Metabolic products of Aspergillus fumigatus Fresenius.**—*Bio-chem. J.*, xxxix, 1, pp. 70–72, 1945.

The metabolic products of a strain of *Aspergillus fumigatus*, isolated from Beaconsfield (Bucks) soil and grown on Czapek-Dox glucose solution, were investigated. The antibiotic, helvolic acid, was isolated, together with substantial amounts of ethylene oxide-$\alpha\beta$-dicarboxylic acid and small quantities of oxalic acid.

THAYSEN (A. C.) & BUTLIN (K. R.). **Inhibition of the development of Fusarium oxysporum cubense by a growth substance produced by Meredith's Actinomycetes.**—*Nature, Lond.*, clvi, 3974, pp. 781–782, 1945.

Acting on a suggestion by Dr. Portheim that gliotoxin-producing fungi may be found useful against plant diseases caused by bacteria and fungi [cf. *R.A.M.*, xxiv,

p. 427; xxv, p. 75], the authors undertook to determine the gliotoxin production of a culture of *Trichoderma viridans* [*T. viride:* ibid., xxiv, p. 68] when grown on beer wash water. As a test organism a standard strain of *Bacterium* [*Bacillus*] *subtilis* was used, which had been proved to be inhibited in its growth by gliotoxin at 6 p.p. million. It was found that though *T. viride* grew abundantly on the beer wash water at a temperature between 25° and 30° C., it had no inhibiting action on the bacterium. It was, therefore, concluded that, under the experimental conditions, *T. viride* had not produced gliotoxin.

Cultures of Meredith's Actinomyetes antagonistic to *Fusarium oxysporum* [var.] *cubense* [ibid., xxiii, p. 447] were also grown on beer wash and on waste liquors from food yeast. After incubation at 30° for one month, the inoculated liquor from food yeast was found to be covered by a pink pellicle of Actinomycetes. When 4 ml. of this medium, freed from living cells by centrifuging, were added to 10 ml. wort agar, the mixture allowed no growth of *F. oxysporum* var. *cubense,* even when the plate was heavily inoculated with a fresh culture of the fungus. Control plates made up of wort agar with 4 ml. of the original medium showed abundant growth of *F. oxysporum* var. *cubense* in two days. After five weeks' growth in food yeast waste liquor, the concentration of the inhibiting substance produced by Meredith's organisms had increased to such an extent that one ml. of the liquor prevented the growth of *F. oxysporum* var. *cubense.*

The active substance responsible for this toxicity was shown to be thermolabile and unable to pass through a porcelain filter. Further work is in progress.

Brien (R. M.) & Dingley (Joan M.). **Rot-proofing of canvas. Preliminary report on experiments carried out in 1944–45.**—*N.Z.J. Sci. Tech.*, B, xxvii, 2, pp. 133–138, 1 fig., 1945.

At the request of the New Zealand Standards Institute a series of investigations was carried out to establish a suitable technique for testing preservatives for canvas, cordage, and the like [*R.A.M.*, xxv, pp. 74, 131]. Of the numerous common moulds isolated from rotted canvas specimens, only *Memnoniella echinata* and *Stachybotrys atra* [ibid., xxv, p. 40] caused appreciable decay of the fabric, and of these the latter was selected as preferable for further trials on account of its prolific production of dark-coloured spores. A method was evolved whereby strips of 12–02. cotton duck, treated with seven chemicals at varying concentrations, were inoculated with *S. atra* and held for three to four weeks under optimum temperature (27° C.) and moisture conditions (tied to sterile 4-in. sections of porous earthenware field pipes 2-in. in diameter and placed in covered glass jars containing 60 ml. sterile water). In this series of tests sodium salicylanilide (shirlan W.S.) conferred protection against rotting at and upwards of 0·5 per cent., while sodium pentachlorphenate (santobrite) was effective from 0·05 to 2 per cent.; at the latter dosage, however, there was a significant loss in tensile strength. Pentachlorphenol and copper oleate in mineral turpentine exerted a preservative action at 0·5 and the copper and zinc naphthenates in mineral turpentine at 0·05 per cent.

In another series of experiments, in which the treated canvas strips were subjected to leaching by a rotating spray of water for ten three-hour periods and dried after each for 1½ in an oven at 45° to 50° before inoculation, there was a greatly increased loss in tensile strength in those treated with salicylanilide and sodium pentachlorphenate even at the maximum strength, while in the case of pentachlorphenol a 3 per cent. concentration would evidently be necessary to prevent disorganization by *S. atra*. Phenyl mercuric acetate permitted significant loss in the tensile strength of leached strips at 0·01 and 0·05 per cent. Leaching did not materially impair the efficiency of copper naphthenate even at the minimum concentration, but in the specimens treated with zinc naphthenate and copper

oleate the reductions in tensile strength were heavy at 0·1 and significant at 0·5 per cent.

GREATHOUSE (G. A.) & AMES (L. M.). **Fabric deterioration by thirteen described and three new species of Chaetomium.**—*Text. Res. J.*, xv, 6, pp. 223–225, 1 fig., 1945.

This is an abridged version, embodying the information likely to interest workers on current fabric and cordage problems, of the authors' recent paper on the relation of *Chaetomium* spp. to cellulose decomposition [*R.A.M.*, xxiv, p. 330].

DEMPSEY (MARY). **The mould-proofing of leather.**—*J. int. Soc. Leath. Chem.*, xxix, 6, pp. 133–142, 2 figs., 1945.

This is a fuller account of the author's paper on mould damage to leather and its control by treatment with para-nitrophenol or beta-naphthol than that already noticed from another source [*R.A.M.*, xxiv, p. 461]. In order to satisfy the requirements of the British Leather Manufacturers' Research Association, treated material should remain practically mould-free for four weeks at a temperature of 30° C. and 100 per cent. relative humidity.

ARENS (K.). **Um fungo destruidor de pinturas a oleo : Cladosporium herbarum (Pers.) var. nigricans (Roth).** [A fungus destructive to oil paintings: *Cladosporium herbarum* (Pers.) var. *nigricans* (Roth).]—*Sum. brasil. Biol.*, i, 1, 13 pp., 8 figs., 1945. [English summary.]

In Brazil, as in Europe, oil paintings are subject to disfigurement by black spots, the agent of which in the author's investigations in Rio de Janeiro was identified as *Cladosporium herbarum* var. *nigricans* [*R.A.M.*, xvii, p. 195 *et passim*]. On a medium of wood extract plus 1 per cent. linseed oil with a 2 per cent. agar base deep black colonies were formed in the course of a fortnight. Microscopic examination of the affected pictures showed that the mycelium of the fungus perforates the superficial pellicle formed by a colloid-chemical process and penetrates the underlying layers, where conidia are produced which rupture the pellicle in their emergence. The infiltration of moisture through the broken protective tegument and the corrosion induced by the metabolism of the hyphae aggravate the trouble, which is not only destructive to the canvases but mars their decorative effects. The pathogen can be effectively combated only by the provision of a dry atmosphere, a difficult matter in the humid climate of the Brazilian coast, but its development may be arrested by the application to the canvas of a fungicide, e.g., zinc silicofluoride, zinc borate, or zinc benzoate, as recommended by Findlay [ibid., xix, p. 719], or 5 per cent. copper oxide, advocated by Mattiello in 'Protective and decorative coatings', New York, 1944.

ELISEI (F. G.). **Sulla germinazione di alcune ife ficomicetoidi extraradicali.** [On the germination of some extra-radical Phycomycetoid hyphae.]—*Atti Ist. bot. Univ. Pavia*, Ser. iv[a], xiii, pp. 131–158, 30 figs., 1941. [Latin summary. Received February, 1946.]

A full account is given of experiments in which the author succeeded in germinating in hanging-drop cultures portions of extra-radical hyphae of the Phycomycetoid fungus [*Rhizophagus*: *R.A.M.*, xviii, p. 470] on *Polianthes tuberosa* var. *flore pleno*. Conidial formation took place, and the new mycelium that arose was ascertained to be that of a *Fusarium*, but the author considers it is probable that the endomycetoid fungus is a Phycomycete, though the possibility of a *Fusarium* or some other fungus being involved has not yet been disproved.

ELISEI (F. G.). **Isolamento e coltura artificiale di un Ficomicete con ife gomiti e a sporgenze laterali coniche.** [Isolation and artificial culture of a Phycomycete with hyphae presenting geniculations and conical lateral swellings.]—*Atti Ist. bot. Univ. Pavia*, Ser. iv^{a}, xiii, pp. 163–166, 3 figs., 1941. [Received February, 1946.]

In this preliminary note, the author states that during his studies on the Phycomycetoid mycorrhizal fungus [*Rhizophagus*: see preceding abstract], he obtained germination of extra-radical hyphae from affected roots; this proved to be a Phycomycete with geniculate hyphae bearing conical lateral swellings.

FRIES (N.). **Beobachtungen über die thamniscophage Mycorrhiza einiger Halophyten.** [Observations on the thamniscophagous mycorrhiza of some halophytes.]—*Bot. Notiser, 1944*, 2, pp. 255–264, 3 figs., 1944.

Of 14 halophytes examined on the island of Nordkoster, off the west coast of Sweden, in the summer of 1939, thamniscophagous mycorrhiza were found in association with *Aster tripolium*, *Matricaria maritima*, *Plantago maritima*, *Glaux maritima*, *Ranunculus cymbalaria*, and *Armeria maritima*. In the case of the three first-named hosts, typical arbuscules [*R.A.M.*, xxiii, p. 402] were formed in all the layers except those of the exo- and endodermis, in *G. maritima* mostly in the outer, and in *R. cymbalaria* almost exclusively in the innermost stratum. The available material of *A. maritima* was too scanty to permit of a detailed description. The vesicles in *Aster tripolium*, *M. maritima*, and *P. maritima* measured 40 to 100 by 30 to 60 μ and occurred both in the inter- and intracellular regions; these bodies were not detected in *G. maritima*. The diameter of the nuclei in the cells of *R. cymbalaria* containing arbuscules was about 30 per cent. larger than those of the univaded ones ($8{\cdot}8 \pm 0{\cdot}2$ as compared with $6{\cdot}5 \pm 0{\cdot}25$ μ). A similar phenomenon was noted in *Juniperus communis*, in *Vinca* [*minor*] by Demeter in Germany [ibid., iii, p. 413], and in *Eriostemon crowei* by McLuckie and Burges [ibid., xii, p. 311].

BROWN (R.). **Biological stimulation in germination.**—*Nature, Lond.*, clvii, 3977, pp. 65–69, 1946.

A comprehensive, documented survey is given of the literature on the stimulation of fungus spores, seeds, and pollen grains by biological agencies. The author concludes that there is abundant evidence to show that germination of these organs will not occur when external supplies of particular activators are not available. These activators are produced in actively metabolizing tissues of a large number of species. It is suggested that dependence upon a particular activator is due to failure to synthesize this or a similar substance.

MADSEN (S. B.). **Om Bekæmpelse af Kartoflens Virussygdome særlig ved Forædling og Fremavl.** [On the control of Potato virus diseases, especially by breeding and propagation.]—*Medd. VetHøjsk. Landbr. Plantedyrk. Afd., Kbh.*, 23, 85 pp., 1944. [English summary.]

The influence of environmental conditions on the reaction of potatoes to virus diseases has been clearly brought out by a series of experiments, in progress since 1915, on the yield of seed from different parts of Denmark [*R.A.M.*, xvii, p. 338]. North Jutland has been shown to be the best area for propagation, while potatoes grown on the islands are particularly subject to virus infections.

Protracted periods of drought, bringing growth to a standstill, enhance the tendency to degeneration, while excessive humidity may also act adversely on the host, which is favoured, on the other hand, by warm weather and a regular water supply. The nature of the soil *per se* exerts no influence on the virus development, but the various amendments added may be of considerable importance in this

respect. Klapp reports from Germany [ibid., xvi, p. 52] that potassium nitrate and potassium chloride are conducive to good stands, while ammonium sulphate and potassium sulphate produce the opposite effect. Danish experiments have shown that the two latter compounds may advantageously be applied before the two former. The exclusive use of potassium chloride is injurious where phosphoric acid is deficient. Liberal supplies of stable manure are particularly beneficial. The question of the right time for planting is somewhat complicated. When the operation is postponed, and the growth period consequently shortened, the symptoms are milder and the plants tend to outgrow them. Late-planted stands, moreover, escape the period of maximum aphid activity and therefore contract fewer fresh infections than those of earlier dates. At the same time, it must be borne in mind that early-planted tubers produce heavier yields than late-planted, while the longer growing-period gives more opportunity for starch accumulation. Therefore, despite the risk of some increase in virus diseases in early crops, late planting cannot be recommended to commercial growers. Pre-germination (sprouting) gives the tubers a good start and helps them to outdistance the viruses.

Four possibilities of combating potato virus diseases exist, namely, cure, immunization, breeding of resistant varieties, and propagation of healthy plants. Cases of actual cure, involving the disappearance of the virus and not merely of the associated symptoms, are exceptional, but there seems to be some prospect of immunizing plants against severe strains of potato virus X by inoculation with milder forms of the same virus. From the practical standpoint, however, only breeding and propagation deserve fuller consideration. In a four-year experiment at Lyngby (near Copenhagen), where virus diseases are prevalent, the state of health and yield of 36 varieties of (*a*) north Jutland and (*b*) local provenance were compared. Only two varieties of origin (*a*) developed leaf roll during the trial period namely, Fürstenkrone and Pepo, and that only to the extent of 1 per cent., while 14 were affected by virus X, viz., Bravo (2 per cent.) Deodara (10), Fürstenkrone (1), Hammersmith (100), Imperia (19), Juli (2), Kerr's Pink (5), King Edward (5), Majestic (2), Pepo (3), Preussen (19), Rheinland (87), Sharpe's Express (2), and Up-to-Date (1). As regards (*b*), the only varieties free from leaf roll were Ackersegen, Bravo, Hammersmith, and Imperia [no figures in respect of either disease are given for Di Vernon], the percentage of infection among the remainder ranging from 7 in King George and Rheinland to 100 in Golden Wonder and Aeggeblomme, closely followed by Preussen (99), Birgitta (98), Magnum Bonum (94), Juli (91), and Askebladet (90). Virus X was less in evidence, except in Hammersmith and Rheinland (both 100 per cent.); 17 varieties were free from infection, and the percentage in the rest ranged from 1 in King George to 52 in Bravo. The maximum yield reductions at the close of the test, compared with the output of healthy stock from north Jutland, amounted to 83 and 82 per cent. in Magnum Bonum and Golden Wonder, respectively, the figures for the other varieties ranging from (—2) in Imperia to 63 in Gelkaragis; Pepo and King George gave a reasonably good performance with 5 and 6 per cent. respectively. Ackersegen was free from leaf roll and virus X throughout the experimental period and sustained only 13 per cent. yield reduction; Beveländer from Jutland was not infected by either virus but the Lyngby stock developed 9 per cent. leaf roll and 6 per cent. virus X, and the reduction amounted to 25 per cent.; Majestic of provenance (*a*) contracted 2 per cent. virus X and that of (*b*) 29 per cent. leaf roll, and the yield was reduced by 27 per cent., while the (*a*) stock of Sharpe's Victor remained healthy, (*b*) showed 25 per cent. leaf roll, and the fall in output reached 15 per cent. Some degree of tolerance appears to reside in the Parnassia, Webb's Early, Kerr's Pink, Silesia, Bravo, and Burbank varieties, the yield reductions in which were not excessively heavy (maximum of 25 per cent. in Parnassia) despite their susceptibility to leaf roll.

The diagnosis of virus infections may be made by Köhler's method of testing the sprouted 'eyes' (a modification of tuber-indexing) [ibid., xv, p. 43] or by the use of differential varieties which react in a particular manner to inoculation by the several viruses, while serological procedures may give valuable assistance in special cases.

Control by propagation, which is still the most effective weapon in the campaign against potato viruses, falls into two parts, one negative and the other positive. The former, which is preferable for the commercial grower, involves the roguing of diseased individuals from a stand and the propagation of the remaining healthy plants [ibid., xi, p. 667]; the latter, more suitable for breeders of seed-potatoes, necessitates the selection of sound plants for propagation. Several organizations exist in Denmark for the propagation of healthy potato stocks. The Danish Alcohol Factories, Ltd., and all flour mills produce seed for the use of their growers, and the former has also established a moorland seed-potato farm in north Jutland, whence stocks are supplied to less favoured districts, notably the Copenhagen region. The methods of selection described in connexion with breeding are also applicable to propagation, for which, however, Oortwijn Botjes's 'clone cultivation' (*Rep. int. Conf. Phytopath. econ. Ent.*, pp. 142–147, 1923) has proved particularly well adapted. The same authority has emphasized the importance of lifting the tubers early (before maturity) as a means of protection against virus infection [*R.A.M.*, ii, p. 519; iii, p. 101]. In 1942, a committee representing various co-operative societies and other interested parties was set up with a view to securing uniformity of grading seed stocks, the following procedure being adopted. Planting material for propagation is provided by the progeny of clone cultivation passed as élite or class A. Two field inspections are made, the first at the onset of flowering and the second a fortnight later, at which the following are the maximum disease counts allowed (per mille): élite, first inspection, extraneous varieties (other than the particular one authorized for cultivation on a given farm) 0, black leg [*Erwinia phytophthora*], leaf roll, and severe mosaic [? virus Y] 2 each; second inspection, 0 for all categories; class A, first inspection, extraneous varieties 1, black leg 2, leaf roll and severe mosaic 10 each; second inspection, 0, 2, 2, and 4, respectively; class B, first inspection, extraneous varieties 2, black leg 10, leaf roll and severe mosaic 20 each; second inspection, 0·1, 5, 5, and 5, respectively. The total numbers of extraneous and diseased plants in class A at the first and second inspections must not exceed 20 and 5, respectively, and in class B, 40 and 12, respectively.

LARSON (R. H.). **Resistance in Potato varieties to yellow dwarf.**—*J. agric. Res.*, lxxi, 10, pp. 441–451, 2 figs., 1945.

Tests with the potato varieties Russet Burbank, Red Warba, and Sebago, showed all three to offer a high degree of field resistance to the yellow dwarf virus, widely transmitted in central Wisconsin by the clover leafhopper (*Aceratagallia sanguinolenta*) [*R.A.M.*, xxiii, p. 490], although there is no direct correlation between the time when a variety reaches maturity and resistance to the disease. For example, the two most resistant varieties were Warba, which matures early, and Sebago, which matures late. The low incidence of the disease in certain varieties exposed to severe virus infection is not the result of the avoidance of any variety by the vector, as was thought in preliminary studies [ibid., xix, p. 39], for the insect was as numerous on resistant as on susceptible varieties, but is considered to be due to the exclusion of the virus in certain individuals in a clone, resistance being effective at the threshold of infection rather than after the virus has become established. A high degree of resistance is usually associated with a low percentage of non-emerging hills, such as constituted an interesting feature of the present tests; and more important was the fact that virus-infected tubers of the three varieties failed to show the characteristic tuber malformation or internal rust-brown

flecking common to yellow dwarf infection, a practical consideration in relation to table-market quality, particularly in the late-maturing varieties. The planting of such resistant varieties in central Wisconsin is recommended not only in order to secure increased yield, but because it should greatly reduce the cost of production with the elimination of the yearly purchase of seed stocks for yellow dwarf areas.

LeClerg (E. L.). **Genetic leaf roll of Irish Potato seedlings.**—*Phytopathology*, xxxv, 11, pp. 877–878, 1 fig., 1945.

A leaf roll of potato seedlings grown from true seed in the greenhouse was observed at the Louisiana Agricultural Experiment Station in the winter of 1943, both crosses, e.g., 528–170 × (XL–72–1), 528–170 × (XL–72–1), and reciprocals, and inbred progenies (XL–72–1 selfed) being involved. The leaf margins rolled upwards, starting at the base of the plant and proceeding towards the apex, and frequently showed a reddish-purple tinge. Stem-graft inoculations with the affected plants on healthy stocks gave negative results, and tubers from rolled individuals, planted in Tennessee in the spring of 1944, yielded normal plants. This type of leaf roll is limited to small seedlings from true seed in clay pots and does not appear in plants grown from tubers produced by these plants. The disorder, therefore, is evidently of a hereditary character, but quite distinct from the non-virus leaf roll previously described as occurring in field-grown plants [*R.A.M.*, xxiii, p. 275].

Kreutzer (W. A.), Henderson (W. J.), & Lane (G. H.). **The comparative effectiveness of certain cutting-knife treatments in the control of ring rot of Potatoes.** —*Amer. Potato J.* xxii, 5, pp. 127–133, 1945.

In experiments carried out near Monte Vista, Colorado, at an elevation of 7,600 ft., 35 sacks of clean but unwashed Red McClure seed-potatoes were cut at five-sack intervals after contamination of the rotary cutting knife with *Corynebacterium sepedonicum*, the knife being dipped in a 5-gal. tank of 0·2 per cent. mercuric chloride. Complete protection resulted after cutting 5, 10, 15, and 20 sacks, but infection appeared after cutting 25. Field plantings of all the sacks produced only one infected plant. When 15 sacks were cut, using a 1-gal. tank of 0·2 per cent. mercuric chloride, 5 sacks were cut safely, but 4 per cent. infection developed in test lots after cutting 10, and no protection resulted after cutting 15. The use of boiling water (199° F.) to sterilize the knife afforded complete protection, but santophen 2 and 7 (commercial mixtures of ortho- and para-benzylphenol) at 0·5, 0·1, and 0·05 per cent. did not prevent infection.

Starr (G. H.) & Riedl (W. A.). **Potato ring-rot and its control.**—*Bull. Wyo. agric. Exp. Sta.* 270, 16 pp., 10 figs., 1945.

After stating that, according to recent surveys, potato bacterial ring rot (*Corynebacterium sepedonicum*) [*R.A.M.*, xxiv, pp. 31, 337] is again increasing in many parts of the United States, the authors describe the symptoms of the disease and give detailed recommendations for its control. These include the use of disease-free seed, produced by methods involving hill- and tuber-indexing and unit planting, and field roguing; seed, knife, and sack disinfection, cellar sanitation, and disinfection of equipment; and the use of resistant varieties, of which Wyoming 27 (U.S.D.A. 47102), one of 13 seedlings remaining free from infection in five years' tests, is being increased with a view to its possible introduction into commerce.

Slosser (J. W.). **An improved sprayer boom for Potatoes and other row crops.**—*Agric. Engng, St. Joseph, Mich.*, xxvi, 11, pp. 453–455, 7 figs., 1945.

A full description is given of an improved sprayer boom, devised and constructed at the Maine Agricultural Experiment Station, for the application, primarily to potatoes, of Bordeaux mixture and calcium arsenate for the joint control of late

blight [*Phytophthora infestans*] and chewing insects. Among the advantages of the new apparatus are greater total coverage of the plants (including the under sides of the leaves, where both fungal and insect attacks tend to originate), increased uniformity and distribution of spray material, and lower operating pressure (100 to 125 compared with the normal 350 to 400 lb.), with consequent reduced costs due to longer life and more economical fittings.

Trials of Potatoes for immunity from wart disease.—*J. Minist. Agric.*, lii, 10, pp. 475–476, 1946.

A further descriptive list is given of new potato varieties found in trials by the Ministry of Agriculture to be immune from wart disease [*Synchytrium endobioticum*: *R.A.M.*, xxiv, p. 33]. They are (early) Ulster Premier, (second early) Ulster Ensign, (early maincrop) Arran Viking, St. Aidan, Ulster Commerce, and Venus, and (maincrop) Stormont Star.

Moore (F. Joan). **A comparison of Fusarium avenaceum and Fusarium caeruleum as causes of wastage in stored Potato tubers.**—*Ann. appl. Biol.*, xxxii, 4, pp. 304–309, 1 graph, 1945.

Wastage of stored potato tubers, partly through the agency of *Fusarium caeruleum* [*R.A.M.*, vii, p. 466; xix, p. 614, and next abstract], and partly through that of *F. avenaceum* [ibid., vii, p. 466], not hitherto reported as a pathogen of potatoes in Great Britain, led the author to undertake a series of experiments with a view to comparing the activities of these two parasites. Of the four varieties tested in clamps for susceptibility, Majestic, King Edward, Doon Star, and Arran, King Edward proved the most susceptible to *F. avenaceum* and Doon Star to *F. caeruleum*. Optimum temperatures for growth on potato-dextrose agar were 20° to 25° C. for *F. avenaceum* and 20° for *F. caeruleum*; maximum temperatures were $>$ 30° and 30°, respectively. For infection of wounded potato tubers, cardinal temperatures for *F. avenaceum* were similar to those for growth on agar, but for *F. caeruleum* the optimum was 15° and the maximum 25°. The optimum temperature for rotting tended, with both species, to be higher in the more susceptible potato varieties. At low temperature *F. caeruleum* caused quicker rotting than *F. avenaceum*, although its rate of growth on agar was little more than half that of the latter. High humidity was particularly favourable to rotting by *F. avenaceum*, while *F. caeruleum* was more tolerant of low humidity. Both species caused quicker rotting in the clamp than in store, although there was no appreciable difference in mean temperature of one and the other, a factor attributed to the higher atmospheric humidity in the clamp.

Padwick (G. W.) & Ganguly (D.). **Stackburn disease of Rice in Bengal.**—*Curr. Sci.*, xiv, 12, pp. 31–32, 2 figs., 1945.

Out of 40 rice seeds of normal or discoloured appearance sown in Roux tubes on cotton soaked in distilled water 21 failed to germinate, and of these six were found to be contaminated by *Helminthosporium oryzae* [*Ophiobolus miyabeanus*], four by *Curvularia lunata*, seven by a white mould tentatively identified as *Trichoconis caudata* [*R.A.M.*, xvi, p. 490], and four by common moulds. Ten of the germinating seedlings bore minute, black sclerotia, 52 to 195 (mean 124) μ in diameter, on the coleoptile, first leaf, and roots, and on transference to a moist chamber four of the infected plants produced the typical white mycelium and caudate conidia, 103·2 to 172·7 by 3·5 to 15·7 (146·2 by 12·6) μ, including the appendage, of *T. caudata*. In inoculation experiments on 500 seeds each of six varieties, *O. miyabeanus* caused the heaviest infection (62 diseased) on Kumargorh and the least (12) on Nigersail, the incidence of *C. lunata* was highest (45) on Latisail and lowest (5) on Patnai 23, and the white mould was most pathogenic (45) to Nigersail and least so (12) to Patnai 23 and Du Lar. The damage caused by *T. caudata* in Bengal has not been assessed.

The treatment of brown bast.—*Adv. Circ. Rubb. Res. Scheme Ceylon* 24, 4 pp., 1945.

Suggestions are made for the treatment of brown bast of *Hevea* rubber [*R.A.M.*, xxv, p. 43] in stands of improved planting material (bud grafts and clonal seedlings) recently come into tapping. The recommendations laid down include making frequent counts of the number of trees with 2 in. or more of the cut dry, particularly in the third and subsequent tapping years, and adopting a milder system of tapping if the number of diseased trees so counted reaches $7\frac{1}{2}$ per cent. of the stand; resting affected trees for a month, and adopting a milder tapping system if the dry area persists or, alternatively, isolating short, dry patches up to 4 in. long and continuing tapping; and, finally, making a trial of the scraping or tapping off treatment, or both, on trees on which the affected area is spreading.

Oidium leaf disease.—*Adv. Circ. Rubb. Res. Scheme Ceylon* 22 (Suppl. 2), 1 p., 1945.

During 1943, there was a shortage of sulphur on many rubber estates in Ceylon, and the following year systematic dusting again could not be carried out, as heavy rains fell during refoliation. Trees old enough to 'winter' were severely affected by *Oidium* [*heveae*: *R.A.M.*, xxiv, pp. 203, 204], and many were attacked later on by *Diplodia* [loc. cit.], causing die-back varying in severity from the loss of a few small branches to the death of the main stem almost to ground-level. It was considered that *Diplodia* had gained entrance owing to the weakened condition of the trees.

Observations on one estate indicated that the extent of the damage caused by *O. heveae* and die-back varied with different clones. Clone BD. 5 was the most severely affected, followed by TJ. 16 and TJ. 1, while GL. 1 suffered least. Individual trees of GL. 1 were, however, almost entirely defoliated, indicating that this clone possesses no natural resistance to *O. heveae* other than that associated with time of wintering.

Further commercial replanting in mid-country areas is not advised, unless it is found that adequate protection can be afforded to young rubber districts by sulphur-dusting, or resistant planting material becomes available. It is pointed out that regulations issued in 1938 provided that permits for new planting should not be issued for land at or over an elevation of about 1,000 ft. above mean sea-level.

Klechetov (A. N.). **A new bacterium on the rubber plant Tau-saghyz.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xlvii, 5, pp. 377–378, 1945.

In the course of field and pot-culture experiments on the nitrogen relationships of the rubber plant, tau-saghyz [*Scorzonera tau-saghyz*], an examination of microtome sections of the mycorrhiza led to the detection in preparations of sound plants, alongside the fungus, of a bacterium which was also present in the roots (particularly at the tips of young roots), peduncles, leaves, flower heads, and seeds. The bacterial cells are spherical, 0·4 to 0·8 μ, single, in pairs, or in short chains; the colonies are drop-like, greyish-white, with an even margin, smooth surface, and semi-transparent. It is thought possible that the organism is able to fix atmospheric nitrogen.

Cross (W. E.). **El efecto del 'carbón' en las Cañas de distintas variedades durante el año agrícola 1944–1945.** [The effect of 'smut' on Canes of different varieties during the agricultural year 1944–1945.]—*Bol. Estac. exp. agríc. Tucumán* 55, 31 pp., 1945.

From this further tabulated survey of the performance of different sugar-cane varieties in respect of smut [*Ustilago scitaminea*] in Tucumán, Argentina [*R.A.M.*, xxiii, p. 189; xxiv, p. 338], it appears that, of the 270 graded as practically immune in 1944, 241 are retained in the same category on the basis of the latest trials, 28 fall

into the group of slightly infected (resistant), and one has been eliminated; of the 67 resistant in 1944, 43 remain in the same class, 14 are raised to the rank of practically immune, and 10 were reduced to the susceptible grade; and of the 66 susceptible in 1944, the reactions of 60 were unchanged, five were re-graded in the resistant class, and one was excluded from future tests.

QUINTANILHA (A.) & BALLE (S.). **Étude génétique des phénomènes de nanisme chez les Hyménomycètes.** [A study of the phenomena of dwarf development in the Hymenomycetes.]—*Bol. Soc. broteriana*, Sér. 2, xiv, pp. 17–48, 1 pl., 10 figs., 1940. [Received January, 1946.]

Wide variations have been observed in the virility of mycelia, obtained under favourable conditions *in vitro*, of cultures of *Coprinus fimetarius*. Cultured simultaneously and under identical conditions, some spores produce vigorous mycelia, with abundant ramification, while others produce only a thread, often very short, with little or no ramification, which it is extremely difficult to transfer. These two forms of mycelia have, therefore, been classified as normal mycelium, and dwarf mycelium, respectively, each of which, particularly the second, is capable of presenting considerable fluctuations in development.

The authors' researches show two cases of stunted development to be in evidence as a result of their studies, one phenotypic and non-hereditary, and the other genotypic in character. One pair of genes (N, n) is responsible for these two forms of normal and dwarf growth. (N) is dominant, the result being that the secondary heterozygous (Nn) mycelia and the fructifications which they engender resemble the homozygous (N, N) mycelia and fructifications. The secondary recessive homozygous (n, n) mycelia are not viable. The two factors (N, n) are transmitted independently of the sterility (A, a, B, b) factors. Certain strains present only phenotypic dwarf development, others only genotypic dwarfing. Irregularities in other strains suggest a superposition of the two phenomena, accompanied possibly by a reduced likelihood of the factors of dwarfing becoming manifest and in the degree that they may so become. The variations in temperature adopted during these experiments (18° to 32° C.) were shown to be without effect on the phenotypic character of the two categories of mycelia. Wide variations of osmotic pressure in culture (0·06 to 12 atm.) were readily supported both by dwarf and normal progeny, without any differential influence on the type and rhythm of growth of either category (N and n). Above 12 atm. dwarfs remain dwarfs, but the normal progeny acquire with the increase in osmotic pressure the morphological characteristics and growth rhythm of the dwarfs. Sugars of different molecular weights act in virtue of the osmotic pressure of their solutions and not in that of their concentrations.

ANDERSSON (O.). **Studier över Boletacéer.** [Studies on Boletaceae.]—*Bot. Notiser, 1943*, pp. 185–202, 1 fig., 5 maps, 1943. [Received January, 1946.]

The author critically discusses the distribution in 'Fenno-Scandinavia', comprising Finland, Norway, Sweden, and Denmark, the ecological relationships, and the taxonomy of *Strobilomyces* (*Boletus*) *strobilaceus*, *B. porphyrosporus*, *B. luridus*, and *B. miniatoporus*.

JØRSTAD (I.). **Parasitsoppene på kultur- og nyttevekster i Norge. I. Sekksporesopper (Ascomycetes) og konidiesopper (Fungi imperfecti).** [Parasitic fungi on cultivated and economic plants in Norway. I. Sack spore fungi (Ascomycetes) and conidial fungi (Fungi imperfecti).]—*Medd. plantepat. Inst., Oslo*, 1, 142 pp., 1945.

This first instalment of a treatise designed to promote the understanding of the fungal parasites of the cultivated and economic crops of Norway comprises a total of 327 critically annotated entries, of which 260 are Ascomycetes and 67 Fungi

imperfecti. The list includes ten new combinations, namely, *Alternaria exitiosa* (Kühn) n. comb. (syn. *Sporidesmium exitiosum* Kühn, *A. brassicae* (Berk.) Bolle [(Berk.) Sacc.: *R.A.M.*, xix, p. 117]) on turnip, kohlrabi, cabbage, and radish leaves; *A. pluriseptata* (Karst. & Har. ex Peck) n. comb. (syn. *Sporidesmium mucosum* Sacc. var. *pluriseptatum* Karst.; *S. pluriseptatum* Peck 1909), the agent of leaf spot of cucumber and vegetable marrow; *Ascochyta compta* (Sacc.) n. comb. the macroconidial state of *Leptosphaeria pratensis* Sacc. & Briard 1885 [ibid., xxi, p. 121] n. comb. (syn. *Sphaeria meliloti* Lasch 1842, *Septoria medicaginis* Rob. & Desm. 1847, *S. compta* Sacc. 1877, *S. trifolii* Cav. 1880, *Stagonospora trifolii* Fautr. 1890, *S. compta* Died. 1912, *S. meliloti* Petr. 1920 [ibid., xxi, p. 527], and the microconidial state, *Phoma meliloti* All. 1892) on lucerne, white and zigzag clovers (*Trifolium repens* and *T. medium*), *Medicago lupulina*, and *Melilotus* sp.; *A. hortensis* (Sacc. & Malbr.) n. comb. (syn. *S. hortensis* Sacc. & Malbr. 1882, *A. boltshauseri* Sacc. 1891 [ibid., xiv, p. 614], *Stagonosporopsis boltshauseri* Died. 1912, *S. hortensis* Petr. 1921) on runner beans (*Phaseolus vulgaris*), often in a virulent form; *Coleroa elegantula* (Rehm) n. comb. (syn. *Venturia elegantula* Rehm 1885) on *Vaccinium myrtillus* berries; *Diplocarpon maculatum* (Atk.) n. comb. (syn. *Fabraea maculata* Atk. 1909 [ibid., xv, p. 260], *Entomopeziza soraueri* Kleb. 1914, *E. mespili* Höhn. 1920, *D. soraueri* Nannf. 1932), with its conidial state *Entomosporium maculatum* Lév. 1861 (syn. *Xyloma mespili* DC. 1815, *Morthiera mespili* Fuck. 1869, *E. mespili* Sacc. 1882) on foliage of quince, pear, *Crataegus monogyna*, and *Cotoneaster integerrima*; *Mycosphaerella dianthi* (Burt.) n. comb. (*Didymellina dianthi* Burt 1936 [ibid., xvi, p. 255]), with its conidial state *Heterosporium echinulatum* on carnation leaves and calyces; *H. macrospora* (Kleb.) n. comb. (syn. *D. macrospora* Kleb. 1924 [ibid., iv, p. 707]), with its conidial state *Heterosporium gracile* on *Iris* spp., especially *I. germanica*; *Phacidiopycnis purpuracea* (Rost.) n. comb. (syn. *Pyrenochaeta purpuracea* Rostr. 1902, *Phacidiopycnis malorum* Potebn. 1912, *Fuckelia conspicua* March. 1921), the conidial state of *Phacidiella discolor* (Mont. & Sacc.) Potebn. [ibid., xxi, p. 225] (syn. *Phacidium discolor* Mont. & Sacc. 1889), causing a black, shiny storage rot of apples; and *Ramularia grevilleana* (Tul.) n. comb. (*Cylindrosporium grevilleanum* Tul. 1863, *R. tulasnei* Sacc. 1879), the conidial state of *M. fragariae* (syn. *Sphaeria fragariae* Tul. 1856, *Sphaerella fragariae* Sacc. 1882) on strawberry leaves.

Baldacci (E.). **Contributo alla sistematica degli Attinomiceti. IX. Saggio di una classificazione e critica al concetto di spora degli Actinomycetales.** [A contribution to the systematics of the Actinomycetes. IX. An attempt at a classification and a critique of the concept of the spore of the Actinomycetales.]—*Atti Ist. bot. Univ. Pavia*, Ser. iv^a, xiii, pp. 99–129, 1941. [Received February, 1946.]

Continuing his studies on the systematic classification of the Actinomycetes [*R.A.M.*, xix, p. 436], the author describes his own classification of these fungi, and discusses their morphology, with special reference to the formation of 'spores' and similar bodies. Descriptions are given of *Actinomyces bostroëmi*, *A. albus*, *A. sulphureus*, *A. carneus*, *A. madurae*, *A. viridis*, *A. melanosporeus*, *A. innominatus*, *A. bovis*, *A. hominis*, and *Proactinomyces asteroides*.

Christoff [Khristov] (A.). Корекции и бележки върху паразитната флора на България. [Revision of, and notes on, the parasitic flora of Bulgaria.]—*Спис. Земед. Опит. Инсти., България.* [*J. agric. Exp. Stas Bulgaria*], ix, 2, pp. 77–85, 1939. [English summary. Received December, 1945.]

Among revised records in this list of Bulgarian fungi [*R.A.M.*, x, p. 210] are the following: *Gymnosporangium juniperinum* on apple, *Ustilago ficuum* on fig, *Phyllosticta tabaci* on cotton, *Hendersonia conorum* on *Pinus silvestris*, *Septoria ampelina*

on American grapes, *S. graminum* Desmazières on hard wheat [see above, p. 155], *Fabraea maculata* on pears, *Uromyces caryophyllinus* on sweet william (*Dianthus barbatus*), *Marssonina juglandis* on walnuts, and *Botrytis allii* on onions.

RHOADS (A. S.). **A comparative study of two closely related root-rot fungi, Clitocybe tabescens and Armillaria mellea.**—*Mycologia*, xxxvii, 6, pp. 741–766, 5 figs., 1945.

As some mycologists are still inclined to regard the fungus *Clitocybe tabescens* as merely an exannulate form of *Armillaria mellea*, the author stresses the importance of isolating the fungus, in the absence of sporophores, in diagnosing root rots caused by these two fungi, particularly in regions where they both occur. He points out the similarity of the root-rot symptoms exhibited by infected plants, of the general appearance and growth of the mycelial sheets, the development of xylostroma outgrowths extruded through longitudinal fissures in the bark of infected roots, the marked predilection of the fungi for oak roots, and their ability to develop either parasitically or saprophytically. The root rot caused by *C. tabescens* differs, however, in the absence of the black, rounded or flattened, cortical, hypogeal, string-like rhizomorphs, the perforate character of the younger mycelial sheets, and their less fan-shaped type of development at the advancing margins.

While in cultural studies of many isolates of these fungi further striking differences were shown, there was considerable variation among the isolates in growth and rhizomorph production, in readiness of fruiting in the case of *C. tabescens*, in transfers from individual isolates in both species, and a more rapid growth in *C. tabescens* than in *A. mellea*, which never showed the slightest tendency to fruit. The aerial rhizomorphs of *C. tabescens* are short and rather blunt at the tips and remain light in colour, while those of *A. mellea* are usually long and needle-shaped and become dark reddish-brown to blackish. Pure cultures of *C. tabescens* failed to show luminescence, whereas those of *A. mellea*, at least when young and growing actively, exhibited it more or less strongly. The temperature range for optimum growth was distinctly higher in the case of *C. tabescens* than in that of *A. mellea* (25° to 30° C. as against 21° to 25°), which accounts for its largely replacing *A. mellea* in Florida and other south-eastern States. A temperature of 36° was close to the upper limit of growth of both fungi, notably *A. mellea*, and 40° maintained for a month proved lethal to both.

Both fungi on potato dextrose maltose agar exhibited a wide P_H range on the acid side of the scale, starting with 3·9 in one series and 4·2 in another. *C. tabescens* usually grew well at all reactions up to P_H 7·1 in one series and 8·7 in another, but fructification was inhibited on alkaline media, while *A. mellea* appeared distinctly intolerant of alkaline conditions, and growth diminished rapidly after the neutral point was reached. It does not appear, however, that the growth of either fungus is sufficiently limited by the P_H reaction to the medium to offer any practicable application from the standpoint of control measures.

SEAVER (F. J.). **Sclerotinia bifrons.**—*Mycologia*, xxxvii, 6, pp. 641–647, 1 col. pl., 2 figs., 1945.

The author repudiates Whetzel's re-naming of *Sclerotinia bifrons* Seaver & Shope as *S. confundans* [*R.A.M.*, xix, p. 569] for the following reasons. Whetzel's claim that the host (*Populus tremuloides*) was misidentified was, in fact, groundless, and the rejection of the original name was illegal under the International Rules of Nomenclature. The correct names and synonymy of the two species occurring on aspens in association with the imperfect *Sclerotium bifrons* should, therefore, be: *Sclerotinia bifrons* Seaver & Shope 1930 (syn. *S. confundans* Whetzel 1940), and *S. whetzelii* Seaver 1940 (syn. *S. bifrons* Whetzel 1940). The imperfect states of these two species are morphologically identical. Their hosts, in the Rocky Mountains and New York State, respectively, are regarded as distinct varieties of *P. tremuloides*.

Waterhouse (Grace M.). **The true nature of Myrioblepharis Thaxter.**—*Trans. Brit. mycol. Soc.*, xxviii, 3–4, pp. 94–100, 1 pl., 4 figs., 1945.

The author, working with a *Myrioblepharis* sp. from a Leicestershire stream, found that this is not a single organism, but a ciliate protozoan, probably a species of *Prorodon*, closely associated with a *Pythium* sp. of the *P. proliferum* type, or with a *Phytophthora* sp. The ciliate settles with its mouth over the tip of the sporangium and grows while situated there; the contents of the sporangium, although not seen to pass into the animal, were not to be found in the vicinity soon after emission. After the ciliate has rested on the sporangium for a time the latter fails to produce zoospores, but releases a mass of protoplasm instead (suggesting that the ciliate is affecting the fungus adversely though not necessarily absorbing substance from it). The newly formed daughter ciliates produced by the mature protozoan have a very short swimming phase before settling on the fungus. These facts are considered to indicate that the animal may absorb nutriment from the fungus, and does not merely perch on it.

Cook (M. T.). **Species of Synchytrium in Louisiana. III. The development and structure of the galls.**—*Mycologia*, xxxvii, 6, pp. 715–740, 12 figs., 1945.

The author describes galls, mostly distinctive, caused by 13 species of *Synchytrium* in Louisiana and held to be considerably more important for description and determination than the characters of the fungi which cause them.

Cutter (V. M.). **The genus Cunninghamella (Mucorales).**—*Farlowia*, ii, 3, pp. 321–345, 2 pl., 1946.

This paper designed to clarify the confused synonymy and overlapping specific descriptions of the genus *Cunninghamella*, presents studies of the type species, *C. echinulata* (Thaxter) Thaxter, and three other species.

Kausche (G. A.). **Ergebnisse und Probleme der experimentellen Virusforschung bei Pflanzen (mit übermicroskopischen Aufnahmen).** [Results and problems of experimental virus research in plants (with ultra-microscopic photographs).] —*Ber. dtsch. bot. Ges.*, lviii, 4, pp. 200–222, 3 pl., 1 diag., 1940. [Received December, 1945.]

Outstanding developments, new at the time of writing, in the experimental study of plant viruses are reviewed and discussed in connexion with the work of the writer and his colleagues at the Biological Institute, Berlin-Dahlem, on the application of ultra-microscopy to various aspects of the tobacco mosaic virus [*R.A.M.*, xxv, p. 83].

Lépine (P.) & Jeantet (P.). **Sur la structure des paracristaux de la mosaïque du Tabac examinés à l'ultramicroscope.** [On the structure of the Tobacco mosaic paracrystals examined under the ultra-microscope.]—*Ann. Inst. Pasteur*, lxviii, 9–10, pp. 466–467, 1 fig., 1942. [Received October, 1945.]

Examined under the ultra-microscope, the crystals of an isolate of the tobacco-mosaic virus from the leaves of infected plants in the Department of Seine-et-Marne, France, presented a fasciculate appearance and minimum dimensions of 7 to 10 by 0·3 to 0·6 and 0·4 to 1·8 mμ, respectively.

Thomson (R.). **Tobacco mosaic. Field investigations at Tobacco Research Station.** —*N.Z.J. Sci. Tech.*, A, xxvii, 2, pp. 104–106, 1945.

In an experiment in 1944–5, one series of plots of 100 tobacco plants each, with four replications, was infected with mosaic (the most widespread and serious disease in New Zealand at the present time) and another kept as far as possible healthy. In the former, the percentages of complete and partial infection and clean plants

were 82·4, 10·4, and 7·2, respectively, the corresponding figures in the latter being 17·8, 25·4, and 56·8, respectively. In 1943–4, the loss from mosaic amounted to 114 lb. per acre, representing a financial loss per acre of £17. 13*s.* 0*d.*, and to a drop in the price per lb. of 1½*d.* In 1944–5 the corresponding figures were 309 lb., £36. 11*s.* 10*d.* and 1½*d.*, respectively.

In 1942–3, 1943–4, and 1944–5, the percentages of infection due to the indiscriminate handling of diseased and healthy plants without washing the hands between each operation ranged from 95·4 to 96, 23·5 to 63·5, and 36 to 67·5 per cent., respectively, compared with a maximum of 5 where the workers' hands were all clean [*R.A.M.*, xxiv, p. 493].

BAWDEN (F. C.) & PIRIE (N. W.). **Further studies on the purification and properties of a virus causing Tobacco necrosis.**—*Brit. J. exp. Path.*, xxvi, 5, pp. 277–285, 1 pl., 1945.

A nucleoprotein absent from the leaves of healthy plants was isolated from those of Canadian Wonder French beans (*Phaseolus vulgaris*) and White Burley tobacco infected by the Rothamsted culture of the tobacco necrosis virus [*R.A.M.*, xxii, p. 377]. It did not crystallize on precipitation with salt-free solutions or during sedimentation by ultra-centrifugation. The nucleoprotein has a sedimentation constant of 498, smaller than that of other plant virus preparations previously investigated. The Rothamsted culture rapidly loses infectivity, and its relationship with the crystallizable protein cannot be exactly defined. It is probable, however, that much of the latter is a non-infective derivative of the virus, sharing many of its physical, chemical, and serological properties.

VAN DER PLANK (J. E.) & ANDERSSEN (E. E.). **Kromnek disease of Tobacco; a mathematical solution to a problem of disease.**—*Sci. Bull. Dep. Agric. S. Afr.* 240, 6 pp., 1944. [Received January, 1946.]

Tobacco kromnek (tomato spotted wilt virus) [*R.A.M.*, xxiii, p. 411] is a disease affecting growing plants, and the source of infection of any one plant appears to be always another living plant. The virus is not seed-borne, and does not survive in dead tissue or in the soil. The natural method of transmission is by species of thrips which, like the virus, have a wide range of hosts. Herein lies the difficulty of control.

On most susceptible species the thrips multiply freely, but on tobacco leaves they appear to be out of place. The local vector in South Africa, *Frankiniella schultzei*, seldom forms colonies on tobacco leaves, and as a rule a high proportion of specimens taken from tobacco leaves are dead. The mobility of the aphid on tobacco is low, and it does not seem to travel far. *Thrips tabaci*, which can carry the virus, and occasionally occurs on tobacco leaves, also appears to find the leaves unfavourable for breeding and movement, and even for survival. On the other hand, tobacco flowers are much more to the liking of the thrips, though in normal cultural practice Virginian-type tobacco is not allowed to flower, the tops being removed.

The hypothesis on which the authors base their work is that, assuming the absence of weeds harbouring the virus and its vectors, infection is always introduced into a field of non-flowering tobacco from without, and does not spread and multiply within. Migrating vectors arrive from outside, invade the fields, and settle at random on the plants. Here they remain, many soon dying, and the rest being unable, ordinarily, to bring a new generation to maturity.

Hence it follows that, since 100 per cent. of the plants seldom become infected, the proportion of plants which does become affected may be reduced by increasing the density of planting. With a given number of vectors invading a field, the mean number settling per plant will vary inversely to the number of plants per acre, and

the corresponding effect on the proportion of plants infected can be determined from the fact that vectors settling at random will be distributed according to the Poisson series. It may thus be calculated that increasing the number of plants per acre n times reduces the proportion of infected plants from $1—q$ to $1—\sqrt[n]{q}$ where q is the proportion of healthy plants at standard density of planting. Verification of the substantial accuracy of this calculation was obtained experimentally, the figure of the calculated infection being 8·41 per cent. as against 8·11 for the observed infection.

Density of planting may be increased by setting out several plants per hill without changing the spaces between the hills, so that no gap occurs in a row unless all the plants in a hill become affected. With n plants per hill, the proportion of totally infected hills is $(1—\sqrt[n]{q})^n$. A table is given for $n=2$ and $n=3$, which shows that planting in pairs will cope with an epidemic which would have destroyed 40 per cent. of a crop set out in the usual way with one plant per hill. Planting in threes is sufficient for all but exceptionally severe outbreaks.

Denser planting is particularly appropriate during the first month or two after transplanting, when the danger of overcrowding is slight, and stands do not require thinning. This is the period when the danger of kromnek is most acute in the Transvaal.

MATTHEWS (E. M.) & HENDERSON (R. G.). **Yellow Special Tobacco, a new flue-cured variety resistant to black root-rot.**—*Bull. Va agric. Exp. Sta.* 346, 7 pp., 3 figs., 1943. [Received January, 1946.]

The Yellow Special bright or flue-cured tobacco variety, which has been grown on the experimental plots at Chatham, Virginia, since 1933, has shown itself highly resistant to black root rot [*Thielaviopsis basicola*: *R.A.M.*, xxiv, pp. 341, 403]. In 1936, for example, when different varieties were grown in infected soil, Yellow Special plants averaged 40 in. high, as against 27 in. for Yellow Mammoth and 12 in. for White Stem Orinoco. In a further test at Blacksburg, in 1942, in lightly infested soil, the average height of Yellow Special plants on 1st July exceeded that of Fawcett's Special by 0·7 in., while on 28th July the figure was 9·3 in. As Yellow Special has been proved to give leaf of good quality and possesses other desirable characteristics, including resistance to black shank [*Phytophthora parasitica* var. *nicotianae*,], sore shin [*Corticium solani*], and damping off [*Pythium debaryanum*], it is now recommended for general use in Virginia.

SMITH (T. E.), CLAYTON (E. E.), & MOSS (E. G.). **Flue-cured Tobacco resistant to bacterial (Granville) wilt.**—*Circ. U.S. Dep. Agric.* 727, 7 pp., 4 figs., 1945.

Bacterial (Granville) wilt of tobacco (*Bacterium* [*Xanthomonas*] *solanacearum*) [*R.A.M.*, xxiii, pp. 318, 460] has caused increasing losses during recent years in the flue-cured belt of North Carolina and Virginia, and is present also in South Carolina and Georgia. About 20 per cent. of the crop has been destroyed annually in the Granville, Wake, and Durham Counties and on some farms losses amounted to as much as 90 per cent. On an average the tobacco crop has been reduced by 10,000,000 lb. annually. Tests showed that flue-cured varieties were slightly less susceptible than Golden Dollar, Virginia Bright Leaf, and similar varieties, but succumbed under severe wilt conditions. The only prospect of breeding resistant types was to start with fresh material and a collection of strains was, therefore, made from Mexico, Central America, and South America. The Colombian collection, T.I. 448A [ibid., xxii, 181], fair-coloured and of not undesirable aroma, though otherwise of poor quality, showed a consistently high degree of resistance to wilt over several years, including those of exceptionally severe incidence in 1939 and 1943. T.I. 448A was crossed with seven flue-cured varieties, and among the progeny, one line from T.I. 448A and 400 (*Bull. N.C. agric. Exp. Sta.* 337, 8 pp.,

1942), of outstanding promise both in wilt resistance and curing trials, gave selections from the F_3 and F_4 which originated several F_5 lines highly resistant to wilt and producing good-quality tobacco.

In view of the urgent need for a flue-cured wilt-resistant strain, the most promising selection was released to certified growers under the name Oxford 26, whose high resistance to wilt is shown by the fact that, although as many as 20 per cent. of the plants may show symptoms of the disease early in the season, nearly all recover and grow normally except for one or two stunted leaves. Under disease conditions in which less than 1 per cent. of standard varieties remained alive, 95 to 100 per cent. of Oxford 26 plants survived.

Growers are recommended to plant Oxford 26 only on soils where wilt occurs, as losses from black shank (*Phytophthora parasitica* var. *nicotianae*) as high as 75 per cent. have been recorded in this variety.

GARCIA (L. A. A.) & ADSUAR (J.). **Studies on Tomato mosaic in Puerto Rico. A new mosaic disease of Tomato.**—*J. Agric. P.R.*, xxvii, 4, pp. 141–148, 1 col. pl., 1943. [Received December, 1945.]

Seedlings of the Marglobe, King, and Newark varieties of tomato propagated for distribution to farmers were rendered commercially useless in 1942 in Puerto Rico by a mosaic-like disease. Under field conditions affected plants showed in their late stages of growth faint yellowish mottling of the leaves with little or no distortion, and such plants produced fairly good crops. Tomato plants attacked early showed pronounced dwarfing and progressive decrease in leaf size, with leaf deformation. Necrosis of the growing tips was frequently observed. The veins showed a purplish colour, especially on the lower surface, followed by necrosis, which extended to form large blotches. Eventually the lamina disintegrated, leaving the midrib bare, and the stems became heavily streaked with black streaks of varying lengths and widths. New shoots from below the affected parts frequently became diseased. The flowers of severely affected plants were commonly malformed and abortive, and produced at most small and streaked fruits.

Sap inoculations on tomato plants induced systemic mottling and inward curling of the margins and tips of the leaves, on tobacco plants systemic vein-clearing, veinbanding, and chlorotic mottling, and on *Nicotiana glutinosa* vein-clearing, systemic mottling, and chlorosis. In order to determine the possible relation of the virus to that recently reported on chilli pepper [*R.A.M.*, xxiv, p. 494] inoculations were made with tomato, tobacco, and *N. glutinosa* virus extracts, and within six days the inoculated plants showed the characteristic symptoms of the pepper disease. The identity of the virus has been substantiated in every case by the severe vein necrosis produced in the large Bell Hot pepper variety. The properties of the tomato virus in regard to mechanical and insect transmission, longevity in vitro, thermal inactivation, and dilution end point were identical with those of the pepper virus, demonstrating that the latter is the same as the former. Passage of the virus through tobacco or *N. glutinosa* appear to result in increased virulence whereas the opposite effect resulted in passage through tomato.

In a few cases tip-blight symptoms appeared in tomato plants inoculated with virus extracts from tomatoes showing tip-blight, a reaction lost in subsequent transfers, only the faint mottling symptoms persisting. It is considered, therefore, that the blight and necrosis sometimes associated with tomato mosaic is due, either to a single organism, or to its interaction with the pepper mosaic virus in the tomato plant. Until more is known about the tip-blight virus its nature must remain doubtful.

Attempts to recover the pathogen from dried leaves of affected tobacco plants and from necrotic tomato leaves failed, and it is suggested that cutting the diseased plants and letting them dry in the sun *in situ* may be a possible means of control.

As the virus is transmitted mechanically, care should be taken not to carry it from affected tomato, tobacco, or pepper plants while working in seed-beds.

PORTE (W. S.) & WALKER (H. B.). **A cross between Lycopersicon esculentum and disease-resistant L. peruvianum.**—*Phytopathology*, xxxv, 11, pp. 931–933, 1 fig., 1945.

A small population of F_2 plants has been raised at the Bureau of Plant Industry, Beltsville, Maryland, from seeds obtained from field-grown, open-pollinated F_1 progeny of crosses between *Lycopersicon peruvianum*, which is resistant to a number of diseases [*R.A.M.*, xxii, p. 502], and the Prince Borghese tomato variety, the former being used as the male and the latter as the female parent. The offspring of out-crosses between these plants and the Pan America and Rutgers varieties and several hybrid tomato combinations show wide variations in fruitfulness and other characters, and it is hoped that some 25 red- and yellow-fruited selections may prove valuable in the development of disease-resistant horticultural varieties.

MOORE (W. D.) & REYNARD (G. B.). **Varietal resistance of Tomato seedlings to the stem-lesion phase of Alternaria solani.**—*Phytopathology*, xxxv, 11, pp. 933–935, 1945.

Tests were carried out from 1942 to 1944 at Tifton, Georgia, on a number of tomato selections that had shown resistance to the collar-rot phase of early blight (*Alternaria solani*) at the United States Vegetable Breeding Laboratory, Charleston, South Carolina [*R.A.M.*, xxiv, p. 35]. After the necessary eliminations had been made, only five selections remained at the close of the experimental period, viz., three F_3 from the original Marglobe ×Devon Surprise cross out-crossed to Pan America, one F_4 from a Cooper Special×Devon Surprise, and one Marglobe selection. The mean number of stem lesions in this group ranged from 248·2 on the Marglobe selection to 25·5 on Cooper Special×Devon Surprise, Marglobe× Devon Surprise×Pan America being intermediate with 34 to 38. These results are considered to justify the use of the selections in a disease-resistance breeding programme. The Targinnie Red, Devon Surprise, and Norduke varieties and their several crosses were also significantly more resistant to *A. solani* than Marglobe.

CALDWELL (R. M.). **Indiana phloem necrosis.**—*Hoosier Hort.*, xxvii, 8, pp. 127–128, 1945.

In this paper (reprinted from *Amer. Nurserym.*, 15th May, 1945), elm phloem necrosis [*R.A.M.*, xxiv, p. 436] is stated to be spreading with alarming rapidity in Indiana, in several cities of which, especially in the south, nearly all the trees have been destroyed within the past two years. For instance, Greenford has lost nearly all its elms, while some 4,000 were killed in Indianapolis in 1944. The Siberian or Chinese and red or slippery elms [*Ulmus pumila* and *U. fulva*] are resistant to the virus responsible for the disease, and should be planted instead of the susceptible American [*U. americana*] in severely threatened areas.

URQUIJO (P.). **Aspectos de la obtención de híbridos resistentes a la enfermedad del Castaño.** [Aspects of the procurement of hybrids resistant to the Chestnut disease.]—*Bol. Pat. veg. Ent. agríc., Madr.*, xiii, pp. 447–462, 16 figs., 1944.

Hybridization between indigenous chestnuts and the Asiatic species, *Castanea crenata* and *C. mollissima*, for the development of resistance to ink disease (*Phytophthora cambivora*) [*R.A.M.*, xxiii, p. 375], may be effected either by cross-pollination or by grafting. Full details are given of the methods employed and of the anatomical characters of the hybrids resulting from the 1943 and 1944 operations. Tests of the hybrids for resistance are planned.

MILLER (P. W.) & SCHUSTER (C. E.). **Transpiration responses of Persian Walnuts and Filberts sprayed with Bordeaux mixture.**—*J. agric. Res.*, lxxi, 10, pp. 465–469, 1945.

In studies of the influence on the transpiration on walnuts and filberts (*Corylus avellana*) of treatment with Bordeaux mixture against *Xanthomonas juglandis* and *X. corylina*, respectively, the results varied greatly, notwithstanding the consistent use of the basal leaves of plants of the same age and vigour, grown under the same environmental conditions. Differences in the number of stomata might, it is thought, do something to account for this lack of uniformity, although counts on representative leaves of comparable ages on different plants showed no marked differences in the number present. As the plants used were seedlings, the variations may have been due to inherent, biological differences in the individual plants and differences in the fertility of various soil mixtures might also account for structural or physiological differences between different groups of plants. The use of older leaves in these experiments may also possibly be associated with the inconsistencies, as they may not have responded so readily to Bordeaux treatments as younger, more active, leaves might have done.

BEILMANN (A. P.). **Some fungus diseases and insects of evergreens.**—*Bull. Mo. bot. Gdn*, xxxiii, 10, pp. 221–223, 1945.

Troublesome diseases on coniferous evergreens in the Middle West of the United States include *Rehmiellopsis bohemica* on white fir (*Abies concolor*) [*R.A.M.*, xix, p. 627], *Sphaeropsis* tip blight of pines [? *S. ellisii*=*Diplodia pinea*], pine leaf rusts (*Coleosporium* spp.), cedar apple rust on juniper [*Gymnosporangium juniperi-virginianae*], and juniper twig and branch blight [*Phomopsis juniperovora*: ibid., xxii, p. 281].

Service and regulatory announcements, April to June, 1945.—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, pp. 30–32, 1945.

BRAZIL. Decree-Law 5,478 of 12th May, 1943, prohibits the transit through São Paulo of banana seedlings and pseudo-bulbs on account of Panama disease (*Fusarium oxysporum* var. *cubense*); of citrus trees and plants through Distrito Federal and bordering municipal districts on account of sweet orange scab (*Elsinoe australis*); of cacao trees through Amazonas, Pará, and Território do Acre on account of witches' broom (*Marasmius perniciosus*); of manioc and cassava root (*Manihot* spp.), through Espirito Santo, Rio de Janeiro, Distrito Federal, Paraná, Santa Catarina, Rio Grande do Sul, Minas Gerais, Goiás, Mato Grosso, and São Paulo on account of *Bacillus manihotus*; and *Hevea* rubber trees through Amazonas, Pará, Marannao, Baia, Goiás, Mato Grosso, and Território do Acre on account of South American leaf disease (*Dothidella* [or *Melanopsammopsis*] *ulei*).

KENYA. The list of declared diseases in Government Notice No. 687, Order of 2nd September, 1937, is amended (12th May, 1945) by the addition thereto of tobacco wildfire (*Bacterium* [*Pseudomonas*] *tabacum*), angular leaf spot (*Bact.* [*P.*] *angulatum*), frog-eye spot (*Cercospora nicotianae*), and mosaic and other viruses [*R.A.M.*, xix, p. 384].

PARAGUAY. By Decree-Law No. 8,051 of 31st July, 1941, the list of declared pests cited in article 11 of Law No. 672 of 3rd October, 1924, has been amended to include in Category A (among those existing in the country) bacterial rot [unspecified] of pineapple, banana bacteriosis [unspecified], 'brusone' disease of rice (*Bacillus oryzae* in association with *Piricularia oryzae*), citrus scab (*E. fawcetti*), orange scaly bark [psorosis], and sugar-cane mosaic: and to category B (among those threatening to invade the country) cassava bacterial wilt (*B. manihotus*), bud rot of palms, citrus root rot [unspecified] and infectious chlorosis, and potato wart (*Synchytrium endobioticum*).

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ROLL-HANSEN (F.). **Undersøkelser over Polyporus annosus Fr., særlig med henblikk på dens forekomst i det sønnefjelske Norge.** [Studies in *Polyporus annosus* Fr., especially in respect of its occurrence in Norway south of the Dovre Fell.]—*Medd. norske Skogsforsøksv.* 24 (vii, 1), 100 pp., 33 figs., 1940. [Received October, 1945.]

Until 1937 *Polyporus* [*Fomes*] *annosus* was known in south-eastern Norway principally as a destructive parasite of spruce (*Picea abies*), responsible for heavy financial losses in standing plantations, whereas its incidence on Scots pine (*Pinus sylvestris*) was of negligible importance. In the west of the country the situation was reversed [*R.A.M.*, xviii, p. 772, xxv, p. 18]. This peculiarity of distribution suggested the existence of two distinct races of the fungus, and field and laboratory investigations were carried out to explore this possibility.

F. annosus was shown, contrary to the general impression, to be not uncommon on pines in the south-east and very prevalent on spruce in the west, and also to spread, not only between its two coniferous hosts, but also between the latter and non-conifers, such as birch, *Empetrum* sp., *Calluna vulgaris*, and *Vaccinium myrtillus*. Fruit bodies of the fungus were further detected on *Abies alba*, *A. balsamea*, *A. nobilis*, *Juniperus communis*, larch (*Larix decidua* and *L. sibirica*), *Picea glauca*, *P. jezoensis*, *P. pungens*, *P. sitchensis*, *P. cembra*, *P. contorta* var. *latifolia*, *P. mugo* var. *rotundata*, Douglas fir (*Pseudotsuga taxifolia*), *Tsuga heterophylla*, alder (*Alnus glutinosa* and *A. incana*), *Crataegus* sp., *Sorbus aucuparia*, and *S. intermedia*.

No significant differences were calculated in the measurements of basidiospores from sporophores collected in various parts of the country or on diverse hosts, though the indication of a smaller length-to-breadth ratio in the south-eastern as compared with the western specimens might be worth following up with more material. Malt agar cultures of 31 isolates from different hosts in the south-east and west also grew at approximately the same rate, nor were any lines or zones formed between the various strains growing in proximity to one another. A pure culture of *F. annosus* from a sporophore on pine infected not only its own host but also birch and spruce plants under aseptic conditions in Erlenmeyer flasks. There was no perceptible variation in appearance or odour between cultures of the fungus from different localities or diverse hosts.

The relatively few reports of *F. annosus* on spruce in the west may be attributed in part to its actually lower incidence and for the rest to the fact that the plantings are too young to have sustained appreciable damage from this source. Its prevalence on Scots pine in the west may be due to a climate unfavourable to the host.

Referring to the above-mentioned hosts of the fungus, the author attaches particular importance to *E.* sp., *V. myrtillus*, and *Calluna vulgaris*, of which the two first-named were probably not previously known to harbour *F. annosus*, while all three, particularly *V. myrtillus* and *C. vulgaris*, are so widespread in Norwegian forests as to assist materially in the transmission of the parasite.

Cytological studies showed that mycelial cells generally contained a large number (10 to 20) of nuclei, the occurrence of only one or two being exceptional. The

maximum number of nuclei, often exceeding 100, developed in the conidiophores before proceeding into the conidia, where they seldom rose above four or sank below one; the basidiospores were usually uni-, occasionally binuclear, while the young basidia mostly contained one, two, or four, rarely five or (?) three. The conidia are smooth and the basidiospores echinulate, the former are less skew than the latter, and the ratio of length to breadth is greater in the former. Clamp-connexions were observed on the hyphae of the fungus both in pure culture and in spruce wood, this being apparently the first record of their occurrence in *F. annosus*.

The mean growth rates of the above-mentioned 31 isolates at 12°, 21·5°, 24·2°, 25·9°, 27·5°, 29·4°, 30°, and 30·7°, reckoned in 0·01 mm. per diem, were 349, 640, 751, 705, 610, 283, 107, and 35, respectively. In a further 46, the growth rate at 12° ranged from 191 for an isolate from spruce to 436 for one from *Abies* sp. Exposure of malt agar cultures to 42° for two hours killed the fungus.

In none of the inoculation experiments with several isolates of the fungus on various plants in sterilized and unsterilized soil was more than a low percentage of infection obtained, denoting the relative weakness of *F. annosus* as a parasite.

In several cultures an abrupt slowing-down of the growth rate was accompanied by abnormalities of appearance, which may be ascribed, at any rate in part, to the production of 'degenerate' mycelia from a single conidium. A high percentage of monoconidial mycelia were found to grow at a considerably slower rate than that of the parent mycelium, and a similar phenomenon was observed in the case of single-basidiospore mycelia.

URQUIJO (P.). **Mycosphaerella patouillardi Sacc., y otros hongos folícolas del Boj.** [*Mycosphaerella patouillardi* Sacc. and other foliicolous fungi of Box.]—*Bol. Pat. veg. Ent. agríc., Madr.*, xiii, pp. 135–140, 4 figs., 1944.

A severe attack on box (*Buxus sempervirens*) by *Mycosphaerella patouillardi* Sacc. was observed in the Sada district of Corunna, the infected foliage bearing white marginal spots dotted with the black perithecia of the fungus. The shape of the asci is described by Traverso in 'Flora italica cryptogama' (Part I, fasc. 2, p. 610, 1913) as cylindrico-claviform, but in the writer's isolates they were more digitiform, with an elongated basal third; in some cases the ascospores were all aggregated in one section of the ascus instead of being evenly distributed throughout its length. The fungus is also recorded (as *Sphaerella patouillardi*) by Da Sousa da Camara *et al.* from Portugal [*R.A.M.*, xvi, p. 563].

Puccinia buxi [ibid., ix, p. 601] appears to be rare in Spain, no mention of the rust being made by González Fragoso in his 'Flora ibérica: Uredales' [ibid., iii, p. 687]. *Chaetodochium buxi* [ibid., xxiii, p. 503] was collected on *B. sempervirens* by González Fragoso at Seville and Madrid. Other Iberian Ascomycetes listed by Unamuno (*Mem. R. Acad. Madr.*, 1941) on box are *Microthyrium microscopicum*, *Hyponectria buxi* [*R.A.M.*, xvi, p. 563; xxiii, p. 503], *Nectria desmazierii* (also recorded by Da Sousa da Camara *et al.* [ibid., xviii, p. 711], *Guignardia buxicola*, [loc. cit.] and *Leptosphaeria buxina*, all from Portugal, and *G. buxi*, *Didymosphaeria buxina*, *Metasphaeria papulosa* f. *limbalis*, and *Phyllosticta* (*Ascochyta*) *buxina* [ibid., xiii, p. 596].

FINDLAY (W. P. K.). **Dry rot and its prevention.**—*J. R. sanit. Inst.*, lxv, 2, pp. 85–90, 1 diag., 1945.

In connexion with the increasing prevalence of dry rot (*Merulius lacrymans* and *Coniophora cerebella* [*C. puteana*]) during recent years [*R.A.M.*, xxiv, p. 393], the author discusses the problem (a major one in some districts where general neglect and war damage have combined to admit moisture into buildings) under the headings of cause and nature, conditions influencing development, cure, prevention, and increase of dry rot as a result of the war. The paper, read at a special Sessional

Meeting of the Royal Sanitary Institute on 17th January, 1945, was followed by a discussion.

EADES (H. W.). **Cause and prevention of decay in wooden buildings, with particular reference to coastal B.C.**—*B.C. Lumberm.*, xxix, 12, pp. 28–29, 92, 94, 96–98, 2 figs., 1945.

Annual losses from decay in timber used for building in British Columbia assume high proportions, but they are largely preventable by the observance of a few simple precautions on the part of builders, householders, and architects, which the author summarizes under the headings of selection of material, use of wood preservatives, drainage, dry lumber, ventilation, decay infection from the ground, decay in posts and poles, protection from intermittent moisture, and sawdust bins. [This paper is also published as *Circ. Dominion For. Serv.* 61.]

TAMBLYN (N.). **Service tests of fluarized Karri rail sleepers in Western Australia.**—*J. Coun. sci. industr. Res. Aust.*, xviii, 3, pp. 254–262, 1945.

Details are given of a co-operative test made by the Division of Forest Products, the Western Australian Government Railways, and the Western Australian Forests Department, in which some 3,000 karri (*Eucalyptus diversicolor*) railway sleepers were installed in 22 test sections of the Western Australian Government Railway after treatment by the fluarizing process, developed and patented by the Western Australian Forests Department during the period 1924–26. The treatment consisted in boiling the green sleepers in a solution of 3·7 per cent. sodium fluoride (95 to 97 per cent. purity), 0·2 per cent. sodium dinitrophenate (100 per cent.), 1 per cent. arsenious oxide (95 per cent.), 0·2 per cent. soda ash (94·9 per cent.), and water. Boiling lasted for 10 hours, and was followed by 36 hours' cooling before removal from the solution.

From the data obtained, the average service life of all fluarized karri sleepers in the test is estimated at 13 years, the figures ranging from 10·1 to 17·8 in the 22 test sections. Untreated karri sleepers, installed in one test section only, gave an average service life of 6·3 years, while the estimated life of untreated jarrah [*E. marginata*] controls in the same section was over 20 years.

The fluarized sleepers failed mainly owing to decay, associated occasionally with termite attack. In some sections where the decay hazard was low, mechanical failure also became important. The weakness of the treatment appears to lie in shallow penetration of the material and liability of the treated sleepers to end-splitting.

KROGH (P. M. D.) & TOOKE (F. G. C.). **Pentachlorophenol solutions for the preservation of wood.**—*Fmg S. Afr.*, xx, 237, pp. 761–769, 1945.

The authors give an account of studies at the Forest Products Institute and Forest Insect Laboratory, Pretoria, on the effectiveness of pentachlorophenol as a timber preservative [*R.A.M.*, xxiv, p. 393]. This material possesses high toxicity, ensuring protection with absorption of low concentrations and consequently small cost, low solubility in water, and low vapour pressure. Its solubility ranges from 4 p.p. million at 0° C. to 35 at 50°. This exceptionally low solubility minimizes loss by leaching, and affords greater permanence than is obtained from more soluble materials. In vapour pressure it ranges from 0·00001 mm. mercury at 0° to 0·0023 mm. at 50°.

Experimental evidence demonstrated that certain coal-tar naphthas dissolved up to 10 per cent. of pentachlorophenol and all possessed high penetrating power. They were all highly inflammable, however, and linseed and other oils prove more satisfactory. Adequate penetration of hemlock [*Tsuga* sp.], Baltic deal [*Pinus* sp.], and South African *P. palustris*, *P. caribaea*, *P. taeda*, *P. patula*, *P. insignis*,

and *P. pinaster* was given by a one-minute cold dip in pentachlorophenol 3·85 per cent. by weight, linseed oil at 21·15 per cent., and mineral turpentine 75 per cent., or pentachlorophenol 4 per cent., seal oil 20 per cent., and mineral turpentine 76 per cent., or pentachlorophenol 4 per cent., sostroil 16 per cent., and mineral turpentine 80 per cent. All these solutions dry quickly and produce no 'blooming' on the surface of the wood.

The paper concludes with notes on the treatment of woods refractory to dipping processes, cost of treatments with pentachlorophenol, fire hazard, the effects of the treatments on glueing, and the toxicity of the substances to workers.

LEBEAU (F. J.). **Systemic invasion of Cabbage seedlings by the downy mildew fungus.**—*J. agric. Res.*, lxxi, 10, pp. 453–463, 3 figs., 1945.

Systemic development of the mildew mycelium of *Peronospora parasitica* in mature cabbage heads in storage [*R.A.M.*, xv, p. 188], in the field [ibid., v, p. 643], and in turnip roots has been reported, but the author believes that this is the first time that the systemic development of *P. parasitica* in the tissues of the hypocotyl and cotyledons of cabbage seedlings has been recorded.

In southern Mississippi, where cabbage seed for plant production for the early spring crop is sown from 15th October to 10th November, severe epidemics of mildew frequently cause a loss of 50 per cent. or more of young plants, the extent of the damage varying with the age of the plants when attacked and with weather conditions. It appears that soil-borne oospores are probably the initial cause of outbreaks. The greatest damage results when plants are infected before the first true leaf is fully developed and when the appearance of the disease is followed by moist, cool days as the prelude to a long period of dry weather. The moist period favours abundant sporulation and rapid spread of infection, while sunny weather thereafter brings about rapid desiccation and necrosis of the infected hypocotyls. The survival of the plants is much greater when sporulation and rapid spread of infection are followed by a long period of cool, cloudy weather, the fungus being retarded by the low temperature, while the seedlings gradually outgrow the disease. If the seedlings have reached the three- to four-leaf stage when infection occurs, the greatest damage results where a long spell of cool, moist weather follows, though the effect is one of arrested growth rather than lethal. Recovery is rapid in dry periods. Plants exposed to continuous low humidity were found by Felton and Walker (in a paper awaiting publication) to outgrow the disease most rapidly, especially at high temperatures, and this accords with observations made under field conditions in Mississippi. The tissues of seedlings attacked by mildew were shown to be infected from a single point of inoculation and thus, once a general infection had been established in a seed-bed, the continued production of inoculum diminished in importance. Systemic infection does not spread from the hypocotyl to the stem. With older seedlings, in which individual points of infection affect only a localized area of the leaf tissues, the ultimate severity of the disease is determined by the number of infections, and in this case it follows that conditions favourable for sporulation and infection must be maintained in order to ensure a continuous severe disease epidemic. Sporulation from mildew lesions has been shown to cease abruptly when exposed to low humidity. Whether a connexion can be shown between the systemic invasion of cabbage seeds and that of cabbage heads by *P. parasitica*, or whether the systemic mycelium in the hypocotyl is sloughed off with the cortex as secondary growth proceeds, remains to be determined.

WHITEHEAD (S. B.). **Control of club root.**—*Gdnrs' Chron.*, Ser. 3, cxix, 3080, pp. 9–10, 1946.

Two important factors predispose cruciferous crops to club root (*Plasmodiophora brassicae*) [*R.A.M.*, xxiv, pp. 260, 475], soil acidity and lack of soil aeration. In

acid soils, more spores are released and the plants are more susceptible than in alkaline soils. The fungus may be present in soils of P_H 5 to 7·8, but germination and infection do not occur at P_H 7·1 to 7·4. As *P. brassicae* appears to require moisture for its germination, low-lying, badly drained soils harbour the disease, but infection may occur in well-drained soil saturated by heavy rain. The author considers the inhibiting factor to be soil aeration rather than absence of moisture. If a soil is well supplied with humus-forming organic matter, promoting aeration, readily absorbing rain, and reducing the free movement of excess water to a minimum, infection is less likely.

Control measures recommended include the prompt destruction by burning of all diseased plants (boiling diseased roots if they are to be fed to stock), rotation, immediate elimination of cruciferous weeds, liming to bring the soil to P_H 7·2 at least, the avoidance of all acid-reacting fertilizers, improvement of soil aeration by attending to the drainage and applying liberal dressings of well-rotted organic material, and the use of mercurous chloride (dusting each hole at transplanting with a teaspoonful of 4 per cent. calomel dust) if crucifers have to be grown in suspected soil or when infected soil cannot be rested longer than one or two seasons.

WALLACE (T.), HEWITT (E. J.), & NICHOLAS (D. J. D.). **Determination of factors injurious to plants in acid soils.**—*Nature, Lond.*, clvi, 3974, pp. 778–779, 2 figs., 1945.

After pointing out that injury to crops on acid soils is probably due in part to excess of soluble manganese, the authors briefly describe the results of studies at Long Ashton, Bristol, on the effects of soil acidity on runner bean (*Phaseolus multiflorus*) and cauliflower. The data obtained showed that the characteristic field acidity leaf symptoms of these crops, i.e., interveinal chlorosis and necrotic spotting of runner bean and incurled margins of cauliflower, result from manganese toxicity, though the effects are modified by the calcium status, being severe with low calcium and substantially decreased by high calcium. It was shown that readily extractable manganese in plant tissues is reduced by high calcium status.

Other work showed that on runner bean the symptoms of calcium deficiency are slightly pale green leaves with necrotic spots, particularly near the tips and round the margins, and progressing inwards interveinally, while on cauliflower the young leaves are distorted, with tips brown and sharply hooked backwards or forwards, and on the older leaves the marginal and interveinal areas become wilted and finally brown. These results clearly demonstrate the importance of manganese toxicity in acid soils.

The Scottish Plant-Breeding Station, Craigs House, Corstorphine, Edinburgh.—*Trans. Highl. agric. Soc.*, Ser. 5, lvii, pp. 75–77, 1945.

Finger-and-toe [club root: *Plasmodiophora brassicae*], the most important swede disease, is to some extent remediable by breeding. The method formerly adopted at the Scottish Plant Breeding Station, of setting aside a small area of highly infested land for the testing of strains and selection of apparently resistant plants, has not proved altogether satisfactory owing to the immense variation in the severity of the parasite from season to season, involving the death of all the plants in one year and their virtual immunity in another. Another disadvantage of trials conducted on these lines is connected with the erratic distribution of the fungus in the soil, which means that an apparently sound plant may merely have occupied a site where the organism was inactive. Considerable use is now being made of a mycological seedling test, based on the argument that a plant capable of withstanding the disease in the early stages of growth will not suffer appreciably from later

attacks, even if nodules are produced. Seed is sown or seedlings pricked out, in sterilized soil in shallow wooden boxes, to which the inoculum is evenly applied by watering with a nodule extract. Some weeks later the young plants are examined and those free from excrescences transplanted to pots for breeding.

HUGHES (S. J.). **A leaf spot of Mangolds caused by Pleospora herbarum (Pers.) Rabenh.**—*Trans. Brit. mycol. Soc.*, xxviii, 3–4, pp. 91–93, 1 pl., 1945.

A spotting of mangold, characterized by circular spots, coalescing on badly infected leaves and causing extensive discoloration, with older spots showing concentric rings of light and dark brown areas with well-defined outer margins, was observed at Llanvaches, Monmouthshire, in October, 1943. Even in the field the fungus produced abundant conidia, giving the spots a sooty appearance. Only *Stemphylium botryosum* [*R.A.M.*, xxv, p. 166] was seen on the spots.

The crops showed evidence of potash deficiency, with premature withering of the older leaves, which drooped round the crown like a rosette. The yield, estimated at 40 tons per acre, appeared normal as the roots had swollen well, although some had hollow centres. Soil analysis confirmed the potash deficiency. Following excessive nitrogen manuring, including dung, with only one potash application, most plants showed leaf-spotting due to *Pleospora herbarum*; those exhibiting potash deficiency were most severely attacked, lesions being numerous and large both on green and partly withered leaves, although the inner and younger unfolding leaves were usually unaffected, suggesting that the spot is largely associated with a weakening of the older leaves and with potash deficiency combined with high nitrogen status. *P. herbarum* was obtained in culture on dung-agar and straw in good light at 10° to 12° C., ascospore measurements being 34·2 to 41·4 by 14·4 to 18 μ and conidia 29·7 to 42·3 by 14·4 to 23·4 μ.

Experimental inoculations with conidia and mycelium on apparently healthy plants showed no infection where the leaf was undamaged, whereas leaves injured with a needle produced typical ring-spot lesions readily. *P. herbarum* was isolated from the diseased tissues. Inoculations on previously damaged petioles were also successful, but not those on roots.

FIFE (J. M.) & CARSNER (E.). **Tip burn of Sugar Beet with special reference to some light and nitrogen relations.**—*Phytopathology*, xxxv, 11, pp. 910–920, 3 figs., 1945.

Sugar beet leaf tipburn, described by Robbins from Colorado as one of the features of mosaic [*R.A.M.*, i, p. 230], has since been observed in California, Washington, Idaho, Utah, and Arizona on field crops, and on greenhouse mother beets in Wyoming and Minnesota as well. The condition, which is of negligible economic importance, is believed to be due to toxic concentrations of substances normally present and develops in plants after protracted cultivation in fertile soil containing an abundance of nitrogen. The toxic substances involved in the disturbance are probably nitrogenous constituents and are accumulated in the root. Complete recovery ensues if the affected plants are transferred to a high light intensity and other conditions favourable to their growth.

BJÖRLING (K.). **Pleospora betae n. sp., die Schlauchfruchtform von Phoma betae (Oud.) Fr.** [*Pleospora betae* n. sp., the ascogenous state of *Phoma betae* (Oud.) Fr.]—*Bot. Notiser, 1944*, 2, pp. 215–222, 4 figs., 1944.

This paper contains the Latin diagnosis of *Pleospora betae*, a fuller account of which, demonstrating its genetic connexion with *Phoma betae* and describing its effects on sugar and fodder beets, has already been noticed from another source [*R.A.M.*, xxv, p. 55].

Reid (W.D.) & Taylor (G.G.). **Control of halo-blight and anthracnose of Beans.**—*N.Z.J. Sci. Tech.*, A, xxvii, 2, pp. 90–93, 1945.

In 1943–4 and 1944–5, dwarf beans [*Phaseolus vulgaris*] infected with halo blight (*Pseudomonas medicaginis*) and anthracnose (*Colletotrichum lindemuthianum*) [*R.A.M.*, xxiii, p. 284] were sprayed twice to four times with Bordeaux mixture or cuprox (copper oxychloride), the Surecrop Stringless Wax variety being used in the former and Masterpiece (or Matchless) in the latter year. Four treatments reduced halo blight to negligible proportions, the incidence on 21st March, 1945, in plots sprayed with 6-8-100 Bordeaux or 5-100 cuprox being 3·2 per cent. as against 81·2 in the controls; the corresponding figures for two applications of Bordeaux (3-8-100) or cuprox in the same season were 20·1 and 17·1 per cent., respectively, and for three in 1943–4 (25th February) 7·75 and 3·75 per cent., respectively (controls 11·5 per cent.). The four Bordeaux and four cuprox treatments increased the seed yield in 1944–5 (20th April) over an area roughly two chains square from 98·8 to 145·1 and 146·2 oz., respectively. Cuprox at 2½–100 was less effective. In 1944–5 (21st March) the incidence of anthracnose was reduced by four applications of Bordeaux 6–8–100 and four of cuprox 5–100 from 35·8 to 20·7 and 16·4 per cent., respectively.

Nicolaisen (N.) & Scupin (L.). **Die Kopffäule der Speisezwiebel. Ein Beitrag zur Feststellung der Ursachen, die zur Kopffäule der Speisezwiebel führen.** [The head rot of table Onions. A contribution to the determination of the causes leading to head rot of table Onions.]—*Z. Lebensmitt. Untersuch.*, lxxxvi, 3–4, pp. 208–217, 9 figs., 1943. [Received November, 1945.]

Full particulars are given of experimental studies carried out in 1941 at Magdeburg, Germany, on the causes underlying the troublesome and destructive development of 'head' ('neck') rot of onions (*Botrytis allii*) [*R.A.M.*, xxv, p. 90] in cold storage. Onions were harvested at three stages of maturity, viz., on 27th August, when the 'necks' were soft and fresh and the bulbs green, on 3rd September, when the bulbs were half-withered, not ready for harvesting, and 16th September, when they were dry and fit for harvesting. A quarter of each lot was (*a*) cleaned and stored two or three days after harvesting, (*b*) of the bulbs harvested while green or half-ripe and cleaned while fresh, a part was subjected to artificial heat for six to eight hours at 35° C., (*c*) allowed to dry naturally in the field, then cleaned and stored, and (*d*) after natural drying and cleaning pre-stored for five days at 20°. The onions were stored at −2·5° to −3°, with a relative humidity of 85 per cent., small batches also being kept at 1°.

The following percentages of infection developed in the four lots from the three harvests: 27th August, (*a*) 77·8, (*b*) 55·8, (*c*) 19·6, and (*d*) 20·9; 3rd September, 88·5, 78·4, 21·5, and 19·2, respectively; and 16th (? 19th) September, 65·7, 45·3 (dried for three days at room temperature), 18·5, and 21, respectively. It is apparent from these data that the natural drying of the onions in the field promoted resistance to storage infection by firmly sealing the junction between the 'neck' and bulb through which the fungi gain ingress, and was a much more important factor in the duration of their keeping properties than was the date of harvesting.

Onions attacked by downy mildew (*Peronospora schleideni*) [*P. destructor*] in the field are particularly liable to storage infection by *B. allii*.

Hopkins (J. C. F.). **The importance of seed disinfection of Ground Nuts.**—*Rhod. agric. J.*, xlii, 5, pp. 432–433, 1945.

The three chief groundnut diseases that require to be guarded against in Rhodesia are seed rot (caused by various soil-inhabiting fungi attacking injured seed [cf. *R.A.M.*, xxii, p. 236], root rot (*Sclerotium rolfsii*) [ibid., xix, p. 579], and rosette

[ibid., xxiii, p. 432]. The first can be overcome, provided the seed is of reasonably good quality, by disinfection with the proprietary mercurial dusts sold locally, applied at the rate of 5 oz. dust per bag (180 lb.) shelled seed. Root rot is not common in Rhodesia, but recurs sometimes during a hot, dry spell, following incessant rain, especially if the crop is planted in heavy or poorly drained soils. Against this disease the measures recommended are seed disinfection as for seed rot, rotation, and planting in well-drained, friable soil. To avoid rosette, a good stand is necessary, in order that the plants may resist drought; seed should therefore be carefully selected and dusted before planting.

IVANOFF (S. S.). **Texas Cantaloupe resists aphids, downy mildew.**—Reprinted from *Sth. Seedsm., 1945*, 2 pp., 3 figs., 1945.

The work described in this paper on cantaloupe resistance in southern Texas to *Peronoplasmopara* [*Pseudoperonospora*] *cubensis* and *Aphis gossypii* has already been noticed from another source [*R.A.M.*, xxiii, p. 373].

ALLINGTON (W. B.). **Wildfire disease of Soybeans.**—*Phytopathology*, xxxv, 11, pp. 857–869, 4 figs., 1945.

The causal organism of tobacco wildfire, *Pseudomonas tabaci* [*P. tabacum*], was found, in the course of an intensive disease survey in 1943, to be prevalent on soybeans in most parts of the United States where the crop is grown on a commercial scale [*R.A.M.*, xxiv, p. 264]. The morphological, physiological, serological, and pathological characters of the isolates from both hosts were identical. Water-soaking of soy-bean leaf tissue, even for a short period, especially by beating rain, greatly facilitates penetration by the pathogen and its spread within the host. Thus, in seven tests with non-water-soaked leaves immersed in a very weak solution of the organism, the average numbers of bacteria per disk (average of 10 leaf disks) after one and 24 hours were 8·8 and 14·7, respectively, the corresponding figures for the water-soaked series being 11,643·1 and 16,543·8, respectively.

Edible and poisonous fungi.—*Bull. Minist. Agric., Lond.*, 23, v + 35 pp., 27 col. pl., 7 diags., 1945. 3*s*. 6*d*.

This attractively written and beautifully illustrated popular handbook, revised by Miss E. M. Wakefield, provides explicit information on 15 edible and 12 poisonous fungi [*R.A.M.*, xxv, p. 173], including means by which they can be recognized, when and where they are likely to be found, and suggestions for their preparation, where suitable, as food.

GARCIA (L. A. A.). **Acrothecium leaf spot of Basella rubra L.**—*J. Agric. P.R.*, xxvii, 4, pp. 149–163, 8 figs., 1945.

Humid atmospheric conditions, accompanied by relatively high temperatures, are held to have favoured the infection of *Basella rubra* by a species of *Acrothecium* [*R.A.M.*, xxiii, p. 347] not previously recorded in Puerto Rico and thought to be a new pathogen of this plant, which is grown for its edible foliage. Infection appeared on the leaves as a few small, yellowish-brown or reddish spots which enlarged slowly in dry weather and sometimes showed yellowish marginal zones or a reddish halo. In wet weather the leaf spots enlarged more rapidly and coalesced to form great patches of necrotic tissue. Lesions frequently developed near the margins and particularly towards the tips. Severely affected plants became chlorotic and heavily diseased leaves abscissed. Both young and mature leaves were susceptible and showed pronounced curling or rolling. Vines showed at first similar spots to those on the leaves but the lesions enlarged into long, lustrous, reddish, superficial spots which occasionally girdled the vines. The parasite confined its attack almost exclusively to the hypodermal tissues of the vines, although where humidity became very high the internal tissues were also involved. A

Rhizoctonia sp. was frequently isolated from *Acrothecium* lesions at the base of the vines or on vines trailing on the ground. A secondary infection of these lesions by *Rhizoctonia* evokes a soft, mushy rot at the point of penetration. Finally, the vines withered completely.

The *Acrothecium* was isolated and grew well on 2 per cent. dextrose agar and other media. Subspherical or irregular sclerotia formed profusely in the medium and measured 160 to 320 μ in diameter. Sporulation was abundant. Inoculations resulted in the production of typical leaf lesions in five to seven days. The mycelium consists of subhyaline, intra- and intercellular hyphae. Conidiophores are amphigenously produced in the central necrotic tissues, arising from substomatal, sclerotioid bodies or pushing out to the surface between dead cells. Few conidiophores were observed in dry conditions, but they abounded when the atmosphere was relatively humid. They were solitary, rigid, or slightly bent, long-septate, up to 500 or more by 19 to 15 μ.; in old cultures they turned brownish. The apex of the conidiophores was swollen with numerous tubercle-like sterigmata, bearing up to 15 or more cylindrical, olive-brown, thick-walled, single conidia, 18 to 92 by 7·5 to 15 μ. The fungus is regarded as a new species and named *A. basellae* [without a Latin diagnosis]. The parasite forms numerous sclerotia in the fallen leaves and with the advent of favourable weather these organs germinate and sporulate. Control was obtained by weekly sprayings with Bordeaux mixture 3–3–50 and 4–4–50, the stronger formula giving the better results. Dry spells checked the virulence of the pathogen, but under humid conditions spraying became necessary. The ploughing-under of infected plant debris and crop rotation are further preventive measures recommended.

Suit (R. F.). **Field results on the control of certain Grape diseases in New York.**—*Bull. N.Y. St. agric. Exp. Sta.* 712, 26 pp., 7 figs., 1945.

Field tests from 1940 to 1944, inclusive, in New York State on the control of vine black rot (*Guignardia bidwellii*), downy mildew (*Plasmopara viticola*), and powdery mildew (*Uncinula necator*) [*R.A.M.*, xxiii, p. 327] showed that Bordeaux mixture (2–2–100 to 8–8–100) effectively controlled both *G. bidwellii* and *P. viticola*, but the 4–4–100 strength is the most reliable in the hands of the growers. Excellent control of *P. viticola* and *U. necator* resulted from three applications (before, immediately after, and two weeks after, bloom) of Bordeaux mixture (4–4–100) plus 1 lb. rosin fish-oil soap, provided adequate coverage was given to the leaves and bunches. The same schedule also controlled *G. bidwellii* in 1940 and 1941, though five applications were necessary in 1944. When *U. necator* alone was present, excellent control followed two applications (immediately after and 10 to 14 days after bloom) of Bordeaux mixture (2–4–100) plus 1 lb. rosin fish-oil soap. The addition of a spreader-sticker increased disease control on the bunches but did not improve control of downy mildew on the foliage. Of the substances tested rosin fish-oil soap, S. E. C. oil (self-emulsifying cottonseed oil), spraysoy A, Grasselli spreader-sticker, and triton B-1956 proved satisfactory. Fermate (2–100) appeared to give promising results against *G. bidwellii*, of which it gave better control than did Bordeaux mixture; it was, however, less effective than Bordeaux mixture against *P. viticola*, and did not control *U. necator*. An experimental organic material, U.S.R. No. 604, was better than Bordeaux mixture against *P. viticola* and equal to it against *U. necator*. It caused some injury when used at a concentration of 1 in 100.

Hewitt (W. B.). **A graft-transmissible mosaic disease of Grapevine.**—*Phytopathology*, xxxv, 11, pp. 940–942, 1 fig., 1945.

About 60 Palamino vines grafted on St. George rootstocks in the Napa Valley of California were severely damaged in 1943 by a foliar chlorosis in which yellow,

cream, and pale green areas fell into different patterns, some of the leaves bearing narrow, cream bands along the smaller veins, irregular, cream blotches along the large veins, or a cream stippling or spattering over the surface, others being entirely yellow with only traces of green along the larger veins, while on some the pale green appeared to have originated in the veins and thence diffused into the surrounding tissue. Mixtures of the various patterns were common. The disease was experimentally shown to be transmissible, with an incubation period of four to five months, by grafting buds from infected vines on to healthy seedlings and rooted cuttings, but not by means of juice from mosaic plants. Except in its mode of transmission, the Californian disease resembles the sap-transmissible Central European vine mosaic described by Straňák *et al.* [*R.A.M.*, xi, p. 280].

Maume (L.) & Dulac (J.). **Carence potassique chez la Vigne décelée par le contrôle chimique de la feuille avant l'apparition de la brunissure.** [Potassic deficiency in the Vine disclosed by chemical analysis of the leaf before the appearance of 'brunissure'.]—*C.R. Acad. Sci., Paris*, ccxxi, 4, pp. 116–118, 1 graph, 1945.

In French vineyard plots occupied by vines in a severe state of 'brunissure' [*R.A.M.*, xvii, p. 222], some of which have been under observation for ten successive years, the potassium oxide content of the foliage is invariably below 1 per cent. of the dry matter from the time the vines are in full flower, and at the harvest it sometimes sinks below 0·3 per cent.; the leaves fall prematurely and their potassium content is literally exhausted. On the other hand, in healthy vines the potassium oxide at flowering is well above 1 and sometimes exceeds 3 per cent., while it seldom falls below 1 per cent. at the harvest. It is thus possible, by means of biochemical analyses, to detect the insidious onset of potash deficiency and take appropriate measures to replenish the soil with this element before the development of the acute symptoms of 'brunissure'.

Lauffer (M. A.) & Price (W. C.). **Infection by viruses.**—*Arch. Biochem., N.Y.*, viii, 3, pp. 449–468, 6 graphs, 1945.

The development of an equation, involving the Poisson series, applicable to the study of virus infectivity at various concentrations, is reviewed. The fundamental assumption underlying this development is that the occurrence of virus infection depends on the requisite number of virus units in the dose actually coming into contact with a susceptible region of the host. The resultant data supported the theory that the quantitative response at the various levels of dosage was, in fact, governed by the occurrence of at least one infectious unit in the dose, and a similar conclusion was drawn from the perusal of a large number of references to the subject in the relevant literature. On the other hand, an alternative hypothesis, assuming that the distribution of the number of positive responses to varying dosage levels is purely a consequence of differences in host susceptibility, was shown to be untenable.

Plantesygdomme i Danmark 1944. Aarsoversigt, samlet ved Statens plantepatologiske Forsøg. [Plant diseases in Denmark in 1944. Annual survey of data collected by the State Phytopathological Experiment Station.]—*Tidsskr. Planteavl*, l, 1, pp. 1–76, 1 map, 1945. [English summary.]

This report, compiled on the usual lines, contains the following items, among many others of interest, in the sections contributed by E. Gram, H. R. Hansen, and Anna Weber [cf. *R.A.M.*, xxiv, p. 401]. Manganese deficiency was widespread early in March, generally in a mild form, on rye in Jutland. On oats and barley it was more prevalent and severe than usual in May and June owing to the enforced substitution of calcium nitrate for ammonium sulphate. In June white mustard

also developed manganese-deficiency symptoms in the form of fair-sized, sunken blotches on the leaves.

Wheat sustained heavy damage (the most extensive since 1927) from *Cercosporella herpotrichoides*, which figured in 54 out of 78 reports submitted during July. Barley was less severely attacked.

Rye ergot (*Claviceps purpurea*) was very common in some localities, sclerotia having in several instances been found occupying more than a quarter of the ears. The same crop was heavily infected on Möen and Stevns by *Ascochyta graminicola* [ibid., xxv, p. 155]; a very low phosphoric acid content of the soil was an associated factor in one field.

Clover rot (*Sclerotinia trifoliorum*) was a limiting factor in the production of red clover for seed in a number of districts [ibid., xxiii, p. 23]; an infection percentage of 80 was not infrequent, and sometimes entire stands were destroyed in the spring. Sweet clover (*Melilotus* spp.) also sustained heavy damage from the pathogen, many fields being a total loss in May and June. Anthracnose (*Kabatiella caulivora*) [ibid., xv, p. 158] killed nearly all the red clover plants in a seed field. The red clover leaf spot caused by *Stemphylium sarciniforme* [ibid., xx, p. 582] closely resembled that associated with potash deficiency except that in the former case the lesions were scattered all over the surface, causing rapid withering and blackening. By July infection had spread to lucerne, which also suffered severely from *Pseudopeziza medicaginis* in Lolland and from *Verticillium albo-atrum* in the same province and Zealand. The former pathogen in some cases defoliated the stems of one-third of the first-cut crop, while the latter damaged the roots to such an extent as to necessitate ploughing-up.

On a Zealand farm it was impossible to grow mangolds and beets for three years prior to the date of writing on account of violet root rot (*Helicobasidium purpureum*).

Potato black scurf and canker (*Corticium solani*) was exceptionally prevalent, destroying over one-third of the sprouts in some parts of Jutland. Wart disease (*Synchytrium endobioticum*) was recorded from 18 new municipalities.

Downy mildew (*Peronospora destructor*) was widespread on onions and shallots, infection originating on the latter host. Growers in Jutland undertook a voluntary inspection of the shallot fields intended for seed. The adhesion of 2 per cent. Bordeaux mixture to the leaves was greatly enhanced by the addition of 2 per cent. spraying oil, which also increased the toxicity of the treatment to the pathogen.

Diseases new to Denmark observed during 1944 included *Gloeodes pomigena* on apple, *Tuburcinia* [*Urocystis*] *gladioli* on *Gladiolus* corms [ibid., xxi, p. 258], and a species of *Physalospora* on privet (*Ligustrum*), while the following new records were published in P. Neergaard's report for 1943–4 from the Phytopathological Laboratory of J. E. Ohlsen's widow [cf. ibid., xxiii, p. 427]: *Alternaria circinans* [*A. oleracea*] on seakale (*Crambe maritima*), *A. matthiolae* on ungerminated seed of *Iberis amara* and *I. umbellata*, *A. senecionis* on ungerminated seed and damped-off seedlings and leaves of cineraria (*Senecio cruentus*), *A. zinniae* [ibid., xxii, p. 389] on ungerminated seed of aster (*Callistephus chinensis*) and cineraria, and *Peronospora mesembryanthemi* on *Mesembryanthemum* sp.

Plant pathology section.—*Rep. Dep. Agric. Can., 1944–5*, pp. 29–34, 1945.

During the period under review, the only noteworthy diseases observed at the Central Laboratory, Ottawa, on intercepted shipments of imported nursery stock were an exceptionally heavy infection by *Sclerotinia narcissicola* [*R.A.M.*, xx, p. 466] in several *Narcissus* shipments from England, and a severe outbreak of a sterile fungus, probably *Rhizoctonia crocorum* [*Helicobasidium purpureum*] in two shipments of bulbous iris from the same country.

Potato bacterial ring rot [*Corynebacterium sepedonicum*: ibid., xxiv, pp. 5, 492] continued to appear in new localities, and in some instances recurred in areas where

it was thought it had been eradicated. About 60 cases were found in Prince Edward Island in 1944.

In an experiment to test the reliability of potato tuber-indexing for the detection of virus diseases, all the eyes from 16 virus-infected tubers were planted. Some eyes from two tubers gave apparently healthy plants, and of 34 affected tubers planted by the tuber-unit method (4 sets each), seven units showed some apparently healthy plants.

In seed examinations of agricultural crops, about 150 species of fungi were identified, including several new species and two new genera. Over 50 per cent. of the species identified had not before been recorded as seed-borne. Examination of 1,000 samples of vegetable seed-stocks from Great Britain and (mostly) the United States, showed that in some samples the seed was so heavily infected by parasitic fungi that it was unfit for sowing, while in most of the remainder the seed required treatment. In a greenhouse test, an application of arasan dust increased germination from 59·4 to 80 per cent. in a sample of 1944 radish seed with 58 per cent. infection by *Alternaria raphani*.

Abies balsamea specimens from Cape Breton Island showed leaf-reddening due to *Rehmiellopsis bohemica* [ibid., xix, p. 627; xxiv, p. 391], this being the first collection from Canada from which mature spores were obtained. The collection of cultures of wood-destroying fungi now comprises 1,100 named specimens, representing 312 species in 57 genera; 174 cultures still await identification. A working key to the cultural characters of these fungi accompanied by full descriptions and illustrations has been prepared, covering over 160 species.

BUCHHOLTZ (W. F.). **Diseases of small grains, Flax, and several vegetable crops in South Dakota in 1942. Diseases of cereals, Flax, and other crops in South Dakota in 1943.**—*Proc. S. Dak. Acad. Sci.*, xxiii, pp. 65–76, 1943; xxiv, pp. 98–107, 1944. [Received January, 1946.]

Particulars are given of cereal, flax, and other crop diseases in South Dakota in 1942 and 1943. Brown rust (*Puccinia rubigo-vera*) [*P. triticina*] was widespread in both years on the Thatcher and Ceres wheat varieties, the former no longer being recommended by the Minnesota Agricultural Experiment Station, where it was developed.

Flax rust and 'pasmo' (*Melampsora lini* and *Sphaerella linorum*) assumed a virulent form in 1942 and the latter also in 1943, when it destroyed the new rust-resistant varieties, Viking and Golden, in the north-east of the State.

Tomato leaf spot (*Septoria lycopersici*) caused unusually heavy defoliation in both seasons, the yield of the early, prolific Bounty and Victor varieties being drastically reduced.

Cottonwood [*Populus deltoides* and other *P.* spp.] rust (*M. medusae*) [*R.A.M.*, xxv, p. 144] developed with almost equal virulence in both years, though appearing 10 to 14 days later in 1943 than in 1942. Fully 90 per cent. of the trees in close-planted shelterbelts in the north-east succumbed to winter injury in 1942–3 following quasi-complete defoliation by the rust by 1st September, 1942. Ash rust (*P. fraxinata*) [*P. peridermiospora*: ibid., xx, p. 138] was so abundant locally in 1943 that the foliar canopy of entire plantings was brown by 15th July. Cord grass (*Spartina* sp.), the alternate host of the fungus, is widely distributed near bodies of water, hence probably the prevalence of the disease in the north-east of the State.

WIEHE (P. O.). **Division of Plant Pathology.**—*Rep. Dep. Agric. Mauritius, 1944*, pp. 11–12, 1945.

Red rot disease of sugar-cane [*Physalospora tucumanensis*: *R.A.M.*, xxi, p. 126] was more prevalent in Mauritius during 1944 than in previous years, initial infection occurring at the growth ring about one-third or half-way up the stem of the

canes, and usually on bent canes, the infection being coincident with the outer bend of the growth ring. The higher incidence in 1944 was ascribed to an after-effect of the cyclone experienced in April.

Experiments on varietal resistance and seasonal variation in the incidence of anthracnose [*Colletotrichum* sp.] on sweet potato at Union Park Sugar Estate showed the disease to be more prevalent during winter months and indicated that the varieties Raisin, Yellow, and Egyptian were more resistant. The yield, however, was poor in all cases.

Among the new records of plant diseases noted are lettuce drop and wilt of *Brassica chinensis* caused by *Sclerotinia sclerotiorum* [ibid., iv, pp. 459, 713], and leaf spot and blight of orchids (*Rhynchostylis* sp. and *Dendrobium chrysotoxum*) caused by *C. gloeosporioides.*

Forty-ninth, fiftieth, fifty-first, and fifty-second Annual Reports of the Idaho Agricultural Experiment Station, 1941, 1942, 1944, and 1945.—*Bull. Ida. agric. Exp. Sta.* 244, 63 pp., 1 graph, 1942; 251, 67 pp., 9 figs., 1943; 255, 63 pp., 1944; 264, 51 pp., 2 graphs, 1945. [Received February, 1946.]

Among the many items of phytopathological interest in these reports, besides those already covered from other sources, the following may be mentioned. A 5 per cent. lysol solution at 95° F. was the most effective disinfectant of those tested by J. M. Raeder and H. C. Kirkpatrick in 1941 for the prevention of the spread of potato bacterial ring rot (*Phytomonas sepedonica*) [*Corynebacterium sepedonicum*] by means of the cutting knife [*R.A.M.*, xxv, p. 181], followed by a commercial product, B.K. (8,000 p.p. million) and acid mercury [mercuric chloride] at the strength recommended for potato treatment. In 1942 the efficacy of B.K. for the object in view was confirmed. In 1943–4 equally good control of *C. sepedonicum* was secured by sterilization of the cutting knife in a solution of B.K. powder at a strength of 12½ level teaspoonsful per gal. water, boiling water, or semesan bel (1 in 60) in combination with a 4 per cent. solution of triton 420. A contaminated picker-type planter was shown by tests at the Aberdeen Branch Station to be much more actively concerned in the spread of ring-rot infection than an assist-feed type, the number of diseased plants in plots on which the former was used ranging from 30 to 33 per cent., compared with none in those planted by the assist-feed. In the 1944–5 trials, hot water proved more effective than therapogen (1 in 20) or B.K. (5,000 p.p.m.) solutions for the treatment of the cutting knife against ring rot, the incidence of infection in the crops from contaminated tubers held against rotating knives in their passage through the three disinfectants being 3, 20, and 32·7 per cent. respectively. When seed containing 3 per cent. diseased tubers cut with a rotary knife undergoing continuous hot-water treatment was treated in B.K. solution as it was cut, only 3 per cent. ring rot appeared in the resultant crop compared with 72·4 in the controls. *C. sepedonicum* can survive a temperature of 6° to 10° for 24 hours on a knife blade, as shown by a test in which 88 per cent. of the plants contracted the disease when healthy seed was cut with a knife dipped in macerated ring-rot tissue previously subjected to the treatment in question. In the absence of any preventive measures, the percentages of diseased plants in stands from seed containing 1, 3, 5, 7, and 9 per cent. ring rot were 58·4, 72·4, 88·9, 84, and 84·3, respectively.

Of 140 monospore isolates from *Fusarium*-wilted potatoes, 55 were tested for pathogenicity in the greenhouse in 1942 by J. M. Raeder and J. E. Kraus. On the basis of the resulting symptoms, five of the isolates were tentatively referred to *F. oxysporum* and two to *F.* [*solani* var.] *eumartii*, the identifications being confirmed by W. C. Snyder.

Three of the most promising hybrids between the Common Pinto bean [*Phaseolus vulgaris*] and Red Mexican U.I. No. 3, which are resistant to both the mosaic and

beet curly-top viruses, were selected by L. Deane and J. M. Raeder for increase in 1945 and distribution in 1946.

In 1944–5 E. C. Blodgett and G. Ken Knight devised a method of combating carrot blight [*Xanthomonas carotae*: ibid., xxiii, p. 423] by 11 to 12 minutes' submersion of the seed in a hot-water bath thermostatically controlled at 128°, agitation being effected by means of a 5-in. propeller directly connected with the drive shaft of an electric motor. The seed cage will hold about 12 lb. carrot seed, but a maximum of 5 lb. is recommended for operation. The heater (1,000-watt immersion) is inserted from below in a separate chamber opening into the main tank with a capacity of 6 gals. The treater can be operated at a capacity of 20 lb. per hour by one man. The following measures, in addition to the exclusive use of hot water-treated seed, are advocated against carrot blight: the planting of 'stecklings' on soil not previously used for the crop, or at any rate not for the past four years, the field being as far removed as possible from any carrot-seed area; and the planting of roots for the seed crop on land that has not been in carrots for at least three years and as far distant as possible from any other seed-field in which these practices have not been adopted.

G. Ken Knight grew some 1,600 tomato plants of 37 selections in [beet] curly-top resistance tests [ibid., xxii, p. 421]. Nine were highly resistant, with less than 20 per cent. of the stand diseased, and 23 moderately so (20 to 35 per cent.), while 60 per cent. of the Pritchard Bounty, and early Chatham plants used as controls were killed.

Peach leaf curl [*Taphrina deformans*], which until 1940 had been reported only from northern Idaho, has since become prevalent and severe in the south-west, where E. C. Blodgett obtained satisfactory control in 1942 by dormant applications of Bordeaux or lime-sulphur.

The major pear disease in the State is fireblight [*Erwinia amylovora*], to which the Old House, Suddeth, Tait No. 2 ,Richard Peters, and Stark Tyson proved the most resistant of 55 varieties included in E. C. Blodgett's inoculation tests in 1941.

Hall (W. J.). **The identity of a mealybug vector of 'swollen shoot' virus disease of Cacao in West Africa.**—*Bull. ent. Res.*, xxxvi, 3, pp. 305–313, 1 fig., 1945.

This is a critical discussion of the identity of *Pseudococcus exitiabilis* Laing (*Bull. ent. Res.*, xxxv, p. 91, 1944), the vector of swollen shoot of cacao in the Gold Coast [*R.A.M.*, xxiv, p. 307], based on the study of an extensive range of material from that colony, Sierra Leone, Ivory Coast, British and French Togoland, and Nigeria. It is concluded, in agreement with Laing, that *P. exitiabilis* is so closely related to *P. njalensis*, recorded on coffee from Sierra Leone (*Ann. Mag. nat. Hist.*, x, p. 472, 1929), that the two species should be united under the latter, prior name.

Schropp (W.). **Bor und Gramineen.** [Boron and Gramineae.]—*Forschungsdienst*, x, 2, pp. 138–160, 12 figs., 1940. [Received January, 1946.]

This is a review, accompanied by explanatory observations, of 72 contributions to the knowledge of the relations between the boron content of Gramineae and their state of health.

Brinton (D.). **An unusual form of epidemic food-poisoning with neurological symptoms.**—*Proc. roy. Soc. Med.*, xxxix, 4, pp. 173–175, 1946.

For 13 months from October, 1942, the population of Aden was intermittently affected by epidemics of food poisoning, which involved about 450 persons. The condition appeared to have been caused by the consumption of Abyssinian wheat shipped to Aden. This wheat was reported to contain the seed of a poisonous weed, called in the local Arabic 'miscara' (tipsy). The symptoms of the condition took

the form of dizziness, headache, lassitude, staggering gait, etc., and persisted for periods up to 72 hours; there were no deaths.

Samples of newly-wharfed Ethiopian grain were examined and found to contain up to 10 per cent. of seeds of flax-darnel (*Lolium linicolum* [*L. perenne*] or [darnel] *L. temulentum*). The poisonous element appeared to be temuline.

ANDRÉN (F.). **Lagringsförsök med betat utsäde.** [Storage experiments with disinfected seed.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1945*, 1, pp. 1–6, 1945.

A tabulated account is given of experiments undertaken to settle various questions that have arisen in connexion with cereal seed-grain disinfection in Sweden, notably with panogen [an organic mercury compound in an oil solvent, with high spreading capacity: *R.A.M.*, xxiii, p. 380]. In a series of excess-dosage tests, the emergence of winter wheat was not appreciably impaired after eight months' storage by treatment at the rate of 175 gm. per 100 kg., while at 350 gm. it still amounted to 84 per cent. of the untreated control samples diminishing at higher dosages to 2·11 per cent. at 2,800 gm. Length of storage assumed importance as a factor in the development of injury from overdosage with panogen only at the higher rates. Rye seed treated with panogen kept somewhat better in paper bags than in closed glass containers.

Panogen appeared to lose more of its mercury content over a 15-month storage period than U.T. 1875b (uspulun dust), but the difference is of no practical importance from the fungicidal standpoint in respect of rye fusariosis [*Calonectria graminicola*] and loose smut of oats [*Ustilago avenae*]. In fact, the efficacy of both preparations was slightly enhanced at the close of the experiment.

ANDRÉN (F.). **Resultat av betningsförsök.** [Results of disinfection experiments.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1945*, 5, pp. 69–73, 1945.

On an average, the best control of wheat bunt [*Tilletia caries* and *T. foetida*] in four seed-grain disinfection trials in Sweden in 1943–4 [see preceding abstract] was secured by dusting with U.T. 1875 b at a dosage of 200 gm. per 100 kg. and 15 minutes' immersion in 0·1 per cent. fusariol-neu. U.T. 1875 b resulted in grain yields of 4,105, 3,370, 4,309, and 3,928 kg. per ha. compared with 3,316, 2,963, 3,996, and 3,425 for the untreated controls in the four localities, the corresponding figures for fusariol-neu being 3,421, 3,444, 4,680, and 3,848, respectively.

From a table showing the incidence of barley stripe [*Helminthosporium gramineum*] over the five-year period from 1940–44 it appears that fusariol dust (200 gm.) was the most effective of the fungicides tested, reducing the average number of infected plants per 10 sq. m. from 221·7 to 0·9, the corresponding figures for panogen (200 ml.) [see preceding abstract], abavit-neu, betoxin 61, and U.T. 1875 b (all at 200 gm.), being 1·3, 1·5, 1·6, and 1·8, respectively.

Over the period from 1939 to 1943, the number of oat plants attacked by loose smut [*Ustilago avenae*] per 10 sq. m. was reduced from 134 to 0·7, 1·8, 3·4, and 9·1 by 0·1 per cent. mercuric chloride-formalin, betoxin 61, fusariol dust (both at 300 gm.), and 300 ml. panogen, respectively, the corresponding figures for 1944 being from 104·8 to 0·0, 0·02, 0·05, and 0·02, respectively.

MACINDOE (S. L.). **New stem rust resistant Wheats to replace Eureka.**—*Agric. Gaz. N.S.W.*, lvi, 12, pp. 530–531, 5 figs., 1945.

In 1941, W. L. Waterhouse and I. A. Watson at Sydney University received specimens of Eureka wheat from Narrabri, New South Wales, showing stem [black] rust [*Puccinia graminis*] infection. In 1942, the author saw heavily infected crops of Eureka at Narrabri [cf. *R.A.M.*, xxiii, p. 95], and in that year a trial at Boggabri gave the following acre yields, primarily as the result of a heavy black rust epidemic: Eureka 3, Eureka (2) 6, Ford 1, Charter 34, Yalta 20, and Celebration 25 bush.

Susceptibility of the formerly highly resistant Eureka has persisted, and has been observed at Richmond and as far south as Temora, while in 1945 heavy losses from black rust were experienced by north-western growers of Eureka wheats. Researches at Sydney indicate that the Eureka wheats have become susceptible to black rust since 1942 as the result of the appearance of a new biotype of race 34 of the rust, which, however, does not so far seem to have spread to Western Australia or South Australia.

Several new black rust-resistant wheats are now becoming available. Of these, Gabo (early maturing) and Charter (mid-season to early) are recommended for general sowing in the north-west, while Kendie (mid-season), Yalta (mid-season), and Celebration (late) could be tried in small areas.

LING (L.). **Epidemiology studies on stripe rust of Wheat in Chengtu Plain, China.**—*Phytopathology*, xxxv, 11, pp. 885–894, 1 map, 1945.

Stem [black], leaf [brown], and stripe [yellow] rusts of wheat (*Puccinia graminis*, *P. triticina*, and *P. glumarum*) are all prevalent in the Chengtu Plain, Szechuan Province, China, but the last-named is often the most important factor in the reduction of the crop. *P. glumarum* is also commonly found on *Agropyron ciliare* and *A. semicostatum* in the plain and surrounding mountains, but since it develops later in the season on these grasses than on wheat, and moreover, the two physiologic races involved were experimentally shown to differ from those on wheat [cf. *R.A.M.*, xix, p. 78], no epidemiological importance is attached to the circumstance.

The yellow rust uredospores were found to germinate best at 11·5° C., the minimum and maximum being just above 0° and 23° to 27°, respectively [ibid., xxiv, p. 141]. Under the conditions of high atmospheric humidity prevailing locally, the period of uredospore viability does not exceed one month and is usually much shorter—not more than a week. At 36° the spores only survive for two days. The winter in the Plain is so mild that the rust can easily hibernate either by means of the uredospores or mycelium, but between the wheat crops a gap of five wet, hot summer months intervenes, during which its survival is precarious. On the mountains to the westward, however, *P. glumarum* has been detected on late-sown spring wheat at 3,000 m. above sea-level throughout the summer, and thence it is conveyed south-eastwards by the wind to autumn-sown crops in the Plain. The sources of inoculum for the subsequent infection of wheat at higher altitudes are uredospores, either overwintered *in situ* or blown back from the lower levels, or both [cf. ibid., xxii, p. 198].

A study of the influence of climatic factors on the incidence of yellow rust in the Chengtu Plain from 1938 to 1944 indicated that the extent and distribution of the late winter and spring rainfall are of outstanding importance. Thus, in the only epidemic year of the seven (1939), the winter and spring rainfall amounted to 29·6 and 175·6 mm., respectively, the relative humidity from February to April to 81·3 per cent., the mean April temperature to 14·1°, and the number of rainy days from February to April to 40. In 1943, a year of relative scarcity of the disease, the corresponding figures were 13 mm., 91·1 mm., 77·2 per cent., 16·8°, and 24 days, respectively, and in 1944, another year with little rust, 21·7, 106·8 mm., 76·2 per cent., 17·5°, and 38 days, respectively, while in the other years covered by the survey the outbreaks were of intermediate severity.

YU (T. F.), WANG (H. R.), FANG (T. C.), & YIN (S. Y.). **Preliminary studies on physiologic specialization in Tilletia tritici and T. levis in China.**—*Phytopathology*, xxxv, 11, pp. 879–884, 1945.

In the course of three years' studies on physiologic specialization in the agents of wheat bunt (*Tilletia tritici* [*T. caries*] and *T. levis* [*T. foetida*]) at the National

Tsing Hua University, Kunming, China, four races of the former (T-1 to T-4) and six of the latter (L-1 to L-6) were separated on the basis of their differential pathogenicity on the Marquis, Mindum, and 2H 80 varieties. *T. foetida* is strongly predominant in the north of the country, while *T. caries* is more prevalent in the south. Race 1 of *T. caries* is the most widely distributed in the south-west, having been found in 17 out of the 18 districts from which material was obtained and comprising 35 out of a total of 45 collections. The three test varieties were all resistant to race 1, while 2H 80 reacted similarly to races 2 and 3, which occurred, together with 1, in the north-western corner of Yunnan, where bunt is usually epidemic. The last-named variety possesses a number of desirable agronomic characters besides bunt resistance fitting it for breeding purposes. Race 4 was collected only once, from Kweichow.

The reaction of the three varieties to races 1 to 4 of *T. foetida* were identical with those evoked by the four of *T. caries*; all were immune from race 5 of the former, and Marquis and Mindum also from 6.

RODENHISER (H. A.) & HOLTON (C. S.). **Distribution of races of Tilletia caries and Tilletia foetida and their relative virulence on certain varieties and selections of Wheat.**—*Phytopathology*, xxxv, 12, pp. 955–969, 1945.

Five new races of *Tilletia foetida* and two of *T. caries* are described, bringing the total number of known races to 31, of which 16 belong to the former species and 15 to the latter [*R.A.M.*, xxi, p. 284]. Three of the new races of *T. foetida* (L-13, L-14, and L-15) were identified from collections made in Mexico, L-11 originated in California, and L-12 in Virginia, while T-15 and T-16 emanated from Idaho and West Virginia, respectively. T-15 differs from the otherwise similar T-12 in the production of susceptible reactions on the Hussar, Martin, Marquis, and Canus wheat varieties. T-16 is the only race pathogenic to both Oro and Hohenheimer. L-11 is distinguishable from L-1 only by the intermediate response of Canus, which is resistant to the latter race. Albit is susceptible to L-12 and all the other winter wheat differential varieties resistant. L-13 is the only known race of *T. foetida* to which Hohenheimer is susceptible. L-14 resembles L-4 except in the intermediate effects on Martin and the susceptibility of Marquis. L-15 is separable from L-7 on the basis of its pathogenicity to Marquis and the intermediate position of Canus.

As indicated by the results of previous surveys, *T. foetida* is the predominant species throughout the United States, though *T. caries* is distributed over an extensive area, being common in the durum section of the Upper Mississippi Valley and greatly increasing in relative prevalence towards the inter-mountain region of the Northwest, where it was once preponderant [ibid., vi, p. 472; ix, p. 768; xiii, p. 86].

Tables are given showing the distribution of the 16 races identified from 62 collections of *T. caries* and of the 15 from 307 of *T. foetida*. It seems clear that the range of specific wheat varieties is the decisive factor in the prevalence of particular races within a given area, T-11 and L-8, for example, having assumed increasing prominence in those regions where Ridit and Oro, respectively, have replaced the old commercial varieties formerly serving as hosts of the more common races.

A number of wheat varieties and selections were resistant to all the races of ordinary bunt tested, viz., T 1–16 and L 1–10, the necessary factor to produce this reaction in the spring wheats apparently being supplied by the inclusion of Hope in the ancestry, while in the case of the winter types a combination of the so-called Oro and Martin factors, e.g., in Rex × Oro and Rio × Rex, provides the essential element of resistance.

Dwarf bunt constitutes a real menace to wheat production, especially in parts of Utah, Idaho, and Montana. It is increasing in importance in the State of Washington,

and has been observed in Wyoming, Colorado, and New York. The Relief, Cache, and Wasatch varieties, though resistant to dwarf bunt [ibid., xxii, p. 472], are susceptible to a few races of the ordinary forms of the fungi, leaving the problems still outstanding of combining the factors in such a way as to confer resistance to both types.

DILLON WESTON (W. A. R.) & TAYLOR (R. E.). **Seed disinfection.**—*J. agric. Sci.*, xxxv, 4, pp. 239–242, 1 fig., 1945.

The following results of experiments in seed-grain disinfection are recorded: substantial control of bunt of wheat (*Tilletia caries*) was obtained by treating seed with an approved organo-mercury seed disinfectant, using three mixing machines, a hand-operated rotational type, a gravity-feed type, and a modification of the latter designed by the authors to give greater efficiency. Using 200 lb. Little Joss wheat with a germination capacity of 99 per cent., mixed with 1 lb. *T. caries* spores, the mean percentage of infection and the variance for each treatment were, respectively, 3 and 2·4 for the rotational machine, 6·2 and 3·5 for the modified gravitational, 9·6 and 13·1 for the gravitational, and 87·8 and 12·2 for the control. Good control of leaf spot of oats (*Helminthosporium avenae*) was obtained when using a scale model of a proprietary rotational-type machine, the working capacity of the commercial type being 1 bush., and that of the model $1\frac{1}{2}$ lb., the oats, infected with *H. avenae*, being mixed with an approved organo-mercury seed disinfectant, and rotated 3, 6, 12, 24, and 48 turns (five replications). The efficiency in terms of the variance of percentage infection and mean percentage of infection for each treatment were, respectively, for no rotation (control) 7·92 and 18·80, for three rotations 31·49 and 18·80, for 12 rotations 9·21 and 3·60, for 24 rotations 4·40 and 3·01, and for 48 rotations 1·34 and 1·89. The variance ratio required for significance was 19 : 1 level = 2·15 and 99 : 1 level = 2·98, and the corresponding differences between means required for significance being 1·72 and 2·34. Thus, even mixing of grain and seed disinfectant was obtained with as few as 48 rotations, the mixing being much less even at 24 turns, although almost as effective. The gravitational machine was not so efficient in producing an even mixing as the rotational, as assessed by the control of *T. caries* and it appeared that the latter gave better disease control; the addition of a felt lining to the feed-hopper of the gravitational machine effected an improvement in its mixing efficiency.

ANGELL (H. R.). **Unavailability of plant food and take-all of Wheat.**—*J. Coun. sci. industr. Res. Aust.*, xviii, 1, pp. 37–46, 1945.

The results of the author's experiments, carried out from 1941 to 1943, inclusive, at Canberra, on the relation of plant nutrition to wheat take-all (*Ophiobolus graminis*) have already been noticed from other sources [*R.A.M.*, xxiv, pp. 91, 402].

DE TEMPE (J.). **Alkaloidvorming door Claviceps purpurea (Fr.) Tul. in saprophytische cultuur.** [Alkaloid formation by *Claviceps purpurea* (Fr.) Tul. in saprophytic culture.]—Thesis, Univ. Amsterdam, 84 pp., 1945. [English and German summaries.]

Of the 18 strains of *Claviceps* from the Centraalbureau voor Schimmelcultures, Baarn, used in the writer's experiments on alkaloid production by the fungus in saprophytic culture, 15 were determined as *C. purpurea* (11 from Dutch rye [*R.A.M.*, xxv, p. 64], one from German rye, and one each from American *Poa pratensis*, *Festuca elatior*, and *Bromus inermis*), the sixteenth from *Glyceria borealis* (United States) as *C.* (?) *wilsoni* [loc. cit.], the seventeenth, from an unknown host in Switzerland, as *C. microcephala* (identified by J. Krebs) [loc. cit.], and the eighteenth as *C. paspali* [ibid., xxiv, p. 233] on *Paspalum leve*

(United States). The last-named was the only one to form an occasional trace of alkaloid on the media selected for the trials, viz., asparagin-saccharose agar, neutralized beer wort agar, and rice. Further tests were carried out on hundreds of the author's own isolates from Spanish, Dutch, Canadian, Polish, and Hungarian ergot, of which the first-named provided twice as high a percentage of alkaloid-forming cultures as all the rest together. However, owing to the rapid loss of the alkaloid-producing capacity with advancing age, it was useless to select strains showing an initial high capacity in this direction.

In peptone-maltose cultures the *C.* spp. made scantier growth than in asparagin-saccharose, but their alkaloid output, expressed by the development of a red coloration on staining with Van Urk's reagent (*Pharm. Weekbl.*, lxvi, p. 473, 1929), was heavier on the former than on the latter substratum, which promoted deterioration. This tendency was to some extent counteracted by the addition to the asparagin-saccharose of tertiary instead of secondary calcium phosphate. Apart from the disparities in their alkaloid yield, the experimental isolates showed marked differences in growth habit, colour, spore and pseudosclerotial formation, and other characters. The large discrepancies in the dry weights, even of identical cultures, may be caused by the influence on the floating capacity of the spores of minute quantities of substances which alter the surface tension, since only floating spores take part in the formation of the fungus mat. The average alkaloid production of measurable positive cultures with 50 c.c. asparagin-saccharose, analysed two days after removal of the mats, was 0·36 mg. in the mat (of which 0·07 mg. was water-soluble) and 0·07 mg. in the filtrate, the corresponding maxima being 1·50, 0·21, and 0·90 mg., respectively [cf. *R.A.M.*, xix, p. 273; xxv, p. 64]. The addition of small amounts of alkaloid to the cultures neutralized the tendency to deterioration referred to above. Crude vegetable extracts, e.g., yeast, beer wort, roots, potato, and rye, exerted a stimulating effect on the growth rate of the cultures but did not promote alkaloid production, negative results in this direction likewise following the use of indole-containing and other nitrogenous substances. Strong sunlight exerted a very adverse effect on the cultures. No alkaloids were produced in cultures subjected to regular shaking. No advantage in respect of alkaloid production was derived from the use of mono-ascospore, conidial, or combined cultures in place of those from sclerotial fragments. This fact, taken in conjunction with the outcome of inoculation experiments on rye, is interpreted as confirming Killian's view (*Bull. Soc. mycol. Fr.*, xxxiv, p. 182, 1918) that *C. purpurea* is homothallic.

Polyploidization of *C. purpurea* appears to be practicable by means of exposure to camphor or acenaphthene, but clones with greatly increased average conidial dimensions generally reverted in a few months to the normal size, and furthermore, they presented no superiority over untreated material for purposes of alkaloid production in saprophytic culture.

Schweizer's method of cultivation of *C. purpurea* on cold sterilized nutrient media [*R.A.M.*, xxi, p. 70] was found to be very laborious, and the fungus did not develop satisfactorily on rye emulsions prepared in this manner.

Throughout the investigation no single factor could be found to induce alkaloid formation even by strains theoretically capable of the process.

VIÉGAS (G. P.). **Tratamentos de sementes de Milho.** [Treatment of Maize seed.]—*Bragantia, S. Paulo*, v, 2, pp. 145–151, 2 graphs, 1945.

None of the fungicides, viz., uspulun dust, semesan jr., and abavit dust (all at 0·2 per cent.), and granosan (0·1 per cent.), applied to three maize varieties, Armour, Itaici, and Catêto, in a five-year series of experiments at the Agronomic Institute, Campinas, São Paulo, appreciably improved germinability or controlled [unspecified] ear rots, and only the first-named produced any consistent increases of yield.

BITANCOURT (A. A.). **O falso exantemo dos Citrus.** [False exanthema of Citrus.]—*Biológico*, xi, 10, pp. 266–268, 1 fig., 1945.

A citrus disease characterized by symptoms corresponding to those described by L. Kung-Hsiang from China under the name of 'convex gum' [*R.A.M.*, xxii, p. 384] is reported to be present in São Paulo, Brazil, where it is known as 'false exanthema'. Infection has been observed on material imported from Japan.

DE ANDRADE (D. X.). **A 'tristeza' dos Citrus.** [Citrus root rot.]—*Bol. Agric., Pernambuco*, xii, 1, pp. 45–48, 1945.

So far the form of citrus root rot associated with the use of sour orange stocks for grafting [*R.A.M.*, xxv, p. 111] has not been observed in Pernambuco, Brazil, but its occurrence in São Paulo [ibid., xxiv, p. 410] constitutes a threat to growers in the former State, where specimens of any suspected material should be submitted to experts of the Ministry of Agriculture for diagnosis and sweet orange stocks used in preference to sour.

CHILDS (J. F. L.) & SIEGLER (E. A.). **Controlling Orange decay.**—*Industr. Engng Chem.*, xxxviii, 1, pp. 82–87, 1946.

Thiourea and thioacetamide in 5 per cent. and quinosol in 8 per cent. aqueous solution, applied as momentary dips, reduced the incidence of stem-end rots (*Diplodia natalensis* and *Phomopsis* [*Diaporthe*] *citri*) and blue and green moulds (*Penicillium italicum* and *P. digitatum*) in Florida orange fruits of commercial varieties [*R.A.M.*, xxiv, p. 447], such as Parson Brown, Pineapple, Seedling, and Valencia, from 40 to 2 per cent. or below. Equally good results were obtained in commercial trials in which 5 per cent. thiourea or thioacetamide was incorporated in the water phase of wax emulsions used as coatings for the fruit. Similarly, 5 per cent. quinosol or thiourea was highly efficacious when applied to the oranges before coating by the solvent wax process. The fungicidal activity of the compounds under investigation is closely linked with their penetration into the fruit tissues, in which the presence of thiourea was demonstrated. The inclusion of both sulphur and amino groups in the molecule appears to be essential to the success of the thiourea and thioacetamide dip treatments. Conflicting results were given by tests with 2-aminothiazole.

HENDRICKX (F. L.). **Sur les fructifications conidiennes de Glomerella cingulata (Stonem.) Spauld. et v. Schr. (Sphaeriaceae).** [On the conidial fructifications of *Glomerella cingulata* (Stonem.) Spauld & v. Schr. (Sphaeriaceae).]—*Rev. Agron. colon.*, ii, 3, pp. 28–30, 1945.

The author's study on the conidia of *Glomerella cingulata*, the agent of coffee anthracnose in the Belgian Congo, has already been noticed from another source [*R.A.M.*, xxiv, p. 412].

ARRAGON (G.), MAINIL (J.), REFAIT (R.), & VELU (H.). **Dissociation d'Eremothecium ashbyii Guilliermond.** [Dissociation of *Eremothecium ashbyii* Guilliermond.]—*C.R. Acad. Sci., Paris*, ccxx, pp. 65–67, 1945.

Details are given of the development of variations in the white, yellow, and orange pigmentation of *Eremothecium ashbyii* [*R.A.M.*, xxiv, p. 448] induced by transference from one medium to another and different methods of culturing, e.g., starting from giant colonies or a physiological serum composed of fragments of mycelium and spores. Such changes do not persist when the cultures are re-transferred to potato decoction or beer wort agar. The type of dissociation under observation is analogous to that described by Mackinnon in connexion with *Candida albicans* [ibid., xix, p. 344].

Velu (H.), Refait (R.), Arragon (G.), & Mainil (J.). **Sporulation d'Eremothecium ashbyii Guilliermond, et dissociation du type.** [Sporulation of *Eremothecium ashbyii* and dissociation of the type.]—*C.R. Soc. Biol., Paris*, cxxxix, 13–14, pp. 662–663, 1945.

Carrot decoction agar was found to be a very suitable medium for the sporulation of *Eremothecium ashbyii*, a spore suspension of which in physiological serum, subcultured on Renaud's bouillon with agar, dissociated into white, yellow, and orange colonies, as already observed in cultures arising from a mixture of mycelium and spores [see preceding abstract].

Kessel (E. L.) & Kessel (Berta B.). **Diptera associated with fungi.**—*Wasmann Collector*, iii, 3, pp. 73–92, 1939. [Received March, 1946.]

This paper comprises the writers' original observations in California on the relationships between flies and fungi and a complete list of the known partnerships, followed by bibliographical references.

Loughnane (J. B.). **A seedling disease of Flax caused by Macrosporium sp.**—*Nature, Lond.*, clvii, 3983, p. 266, 1946.

A sample of Newlands flax seed received in Dublin in 1944 and characterized by the dull colour of a very large proportion of the seed was sown in pots in a glasshouse. The cotyledons of some of the resulting seedlings developed brown lesions, usually near the margin, but sometimes present as minute spots near the centre. When the affected seedlings were kept in a moist atmosphere the cotyledons died and became covered with an olivaceous mould. The fungus spread to the hypocotyls of the diseased seedlings and to the hypocotyls and cotyledons of healthy ones in contact with them. Such seedlings in most cases rapidly succumbed.

The fungus showed club-shaped [? obclavate], light brown, muriform, 6- to 12-septate conidia, borne singly or in pairs on the ends of short, straight, light brown, septate conidiophores. The conidia, identified as belonging to a species of *Macrosporium* [*Alternaria*], ranged from 60 to 105 μ long (excluding the beak which averaged 75 μ) by about 25 μ broad at the widest point. The fungus appeared to be carried as mycelium in the seed coat.

Healthy flax seedlings were rapidly killed by inoculation with conidia from a pure culture of the fungus, the radicles, hypocotyls, and cotyledons being invaded and destroyed.

A similar fungus was found on a diseased crop of Buda flax and on seed from the lot from which this crop had been grown. Dead flax seedlings of an unknown variety also yielded the same fungus. Observations demonstrated that the organism is favoured by high atmospheric humidity. This appears to be the first record both of the disease and of the fungus. Further work is in progress.

Vallega (J.). **Especialización fisiológica de Melampsora lini, en Argentina.** [Physiologic specialization of *Melampsora lini* in Argentina.]—*An. Inst. fitotec. S. Catalina, 1942*, iv, pp. 59–74, 1944. [English summary.]

From 1939 to 1941 the presence in Argentina of physiologic races 19, 20, 22, 42, and 42 A of flax rust (*Melampsora lini*) [*R.A.M.*, xx, p. 18] was demonstrated by means of inoculation experiments with uredospores from leaves collected in different parts of the country. Races 42 and 42 A have not hitherto been described. The former infects all the differential varieties listed by Flor [ibid., xix, p. 655] except Bombay, and the latter all but Bombay and Argentine C.I. 705. Of all the races of *M. lini* so far distinguished, 42 attacks the largest number of varieties, mostly in a very severe form. Among over 200 indigenous and foreign varieties and selections tested, all those of the former group were susceptible to the races prevalent in the country, while of the latter (fibre or intermediate type), Saginaw ×

Bombay C.I. 671 was immune from all, J.W.S.C.I. 708, T. Tammes C.I. 332, and T. Tammes 766 susceptible only to 42 and 42 A, and Vologda, Leningrad, Pensa, and others resistant to 19. Foreign linseed strains resistant to the rust included Ottawa 770 B.C.I. 355 (races 19 and 20), Italia Roma 2090 and Usigus Sind Karachi 2864 (19, 20, and 22), and Bombay C.I. 42, Punjab C.I. 20, and Indian Types 29 and 46, immune from all races occurring in Argentina, these Indian selections being of great importance from the breeding standpoint.

The results of the present work, together with those obtained by Flor [ibid., xix, p. 655], Straib [ibid., xviii, p. 679], and Waterhouse and Watson [ibid., xxi, p. 256], show that the race populations of Argentina, the United States, Germany, and Australia are entirely different and within each geographic population the races possess common characters indicative of their origin.

Severin (H. H. P.) & Freitag (J. H.). **Additional ornamental flowering plants naturally infected with California Aster yellows.**—*Hilgardia*, xvi, 12, pp. 599–618, 6 pl., 4 figs., 1945.

The host range of the California aster yellows virus [a strain of aster yellows virus] among ornamental flowering plants naturally infected includes 45 species and one interspecific hybrid in 38 genera belonging to 17 families, including those previously reported [*R.A.M.*, xxiii, p. 20]. Previously non-infective short- and long-winged aster leafhoppers (*Macrosteles divisus*) transferred the virus from naturally infected plants to healthy celery and asters, respectively. Noticeable symptoms, which vary with the size of the plant when infected, include stunting, internodal shortening, production of axillary shoots from the bud normally dormant in the axil of each leaf, upright or vertical position of the leaves and stems, cleared venation, cupping, twisting, and chlorosis of the leaves. The most striking symptoms are phyllody (the tendency of the floral organs to resemble leafy structures), virescence, and proliferation of the flowers.

Frazier (N. W.) & Severin (H. H. P.). **Weed-host range of California Aster yellows.**—*Hilgardia*, xvi, 12, pp. 621–650, 4 pl., 1945.

Of the leafhopper vectors of the Californian aster yellows virus [see preceding abstract] the short-winged aster leafhopper (*Macrosteles divisus*) completed its life-cycle on 19 species of weed hosts; the long-winged aster leafhopper (*M. divisus*) on 25, the mountain leafhopper (*Colladonus montanus*) on 27, and the geminate leafhopper (*Idiodonus geminatus*) on 28.

In inoculation experiments, 25 species of weeds in 24 genera belonging to 14 families were infected by means of one to four vectors, including 22 annuals, two biennials, and one perennial, with this strain of the aster yellows virus, which was transferred by short- or long-winged aster leafhoppers, previously non-infective, from the infected weeds to asters. Symptoms of aster yellows appeared in six species of inoculated weeds, but the virus was not isolated from them. The symptoms partially disappeared in some species.

Weeds of 41 species in 31 genera of 14 families were shown to be naturally infected with California aster yellows virus, including 28 annuals, five annuals or biennials, four biennials, and four perennials, the virus being transferred to asters by previously non-infective leafhoppers. Five other weed species developed characteristic aster yellows symptoms in nature, but it was not found possible to recover the virus from them. It passes the winter in annual, biennial, and perennial weeds and in the leafhopper vectors.

Kunkel [*R.A.M.*, vi, p. 297] was unable to infect Leguminosae with the New York aster yellows virus [aster yellows virus], but in these experiments three species of weeds of this family proved susceptible to the Californian strain of the virus. This difference in host range may constitute another difference between these strains.

Overlapping host ranges of the two viruses include three species of weeds belonging to two families.

Campi (Maria D.). **Ensayo comparativo de la eficacia de tres fungicidas sobre la enfermedad del Clavel producida por Heterosporium echinulatum (Berk.) Cke.** [Comparative assay of the efficacy of three fungicides against the Carnation disease caused by *Heterosporium echinulatum* (Berk.) Cke.]—*Publ. Misc. Minist. Agric., B. Aires*, Ser. A, ii, 11, 12 pp., 1 graph, 1946.

Of three fungicides tested for their toxicity to *Heterosporium echinulatum* [*Didymellina dianthi*] on the very susceptible Betty Lou carnation variety under glass at the Plant Quarantine Station, J. C. Paz, Buenos Aires, Argentina, in 1943, only lime-sulphur (1° Baumé) gave effective control. The plants situated in the dry and sunny quarter of the greenhouse responded much more favourably to treatment at three-weekly intervals than those on the damp, shady side receiving weekly or fortnightly applications.

Mosnat (H. R.). **Control of Lily disease.**—*Horticulture*, xxiii, 18, p. 458, 1945.

In 1944 the writer successfully combated blight (*Botrytis*) [*elliptica*] on Formosan lilies [*R.A.M.*, xxii, p. 434] in Iowa by spraying with dithane [disodium ethylene bisdithiocarbamate; ibid., xxv, p. 149] at the rate of 5 oz. per 5 gals. water, with the addition of $\frac{3}{4}$ oz. zinc sulphate (36 per cent. zinc) and $\frac{3}{8}$ oz. hydrated lime. The same formula was effective against [unspecified] blights of *Phlox*, *Chrysanthemum*, and *Liatris*.

Lihnell (D.). **Försök rörande vissnesjuka hos Azaleor.** [Experiment relating to Azalea wilt disease.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1945*, 5, pp. 65–69, 3 figs., 1945.

From wilted azalea [*Rhododendron*] plants imported into Sweden the writer isolated *Cylindrocarpon radicicola* [*R.A.M.*, xxii, p. 319] and inoculated four strains of the fungus grown on sterilized oats into 18 one-year-old plants each of the Mme Petrick, Paul Schäme, and Pink Pearl varieties and an unnamed sort. The number of successful tests was much higher on wounded than on uninjured plants (30 as compared with 7 for all four cultures). The development of the fungus is promoted by deep planting, heavy shade, excessive watering, and abrupt fluctuations of temperature.

Jones (F. R.). **Winter injury and longevity in unselected clones from four wilt-resistant varieties of Alfalfa.**—*J. Amer. Soc. Agron.*, xxxvii, 10, pp. 828–838, 1945.

Small clones of unselected lucerne plants of the wilt [*Corynebacterium insidiosum*]-resistant varieties, Ladak, Hardistan, Orestan, and Ranger, were grown for five years in a Wisconsin nursery with a cutting schedule and methods of cultivation designed to favour longevity [*R.A.M.*, viii, p. 110; xxiv, p. 192]. Early in the fifth summer (1944) between a quarter and half the clones were dead, and about half the survivors in poor condition.

Despite the comparatively mild winters during the experimental period, a few clones had been winter-killed, while among the diseases present, bacterial wilt and downy mildew (*Peronospora trifoliorum*) had selectively destroyed susceptible clones. However, these pathogens, together with winter injury, appear to have killed only about half the dead clones and were not primarily responsible for the unthriftiness of the living ones. The other parasitic diseases, leaf spot (*Pseudopeziza medicaginis*) and black stem (*Ascochyta imperfecta*), and insect pests present in the nursery do not seem to have been sufficiently selective in their action to account for the destruction or deterioration of so many of the clones. The unsatis-

factory performance of the clones must, therefore, be attributed in the main to winter injury of widely varying character and extent, some forms involving stunting of the tops and others reduction in the number of stems from bud-killing, with or without more or less serious damage to the root and crown decay. Leafhopper (*Empoasca fabae*) infestation and fungal infection are believed to have retarded the effectual recovery from winter injury, but the evaluation of such relationships must await the critical study of properly selected material. Meanwhile, winter injuries and their consequences in clones under field conditions appear to be sufficiently well-defined to serve in the selection, at any rate for local needs, of longer-lived strains of lucerne.

WEIMER (J. L.). **A new species of Colletotrichum on Vetch.**—*Phytopathology*, xxxv, 12, pp. 977–990, 4 figs., 1945.

Vetches (*Vicia* spp.) in Florida and Georgia are subject to infection by an anthracnose causing the development on the leaves of roughly circular, elliptical, or angular, pale green, whitish or yellow-olive lesions, gradually fading to light brown, grey or nearly white, with a narrow Brussels brown, raw umber, bay, or warm sepia border, which measures 1 to 2 mm. in diameter. The linear, pale green lesions on the young stems and petioles, 1 to a few mm. in length by less than 1 mm. in width, darken with age, usually to warm sepia, and tend to coalesce with adjacent spots over large areas. Under humid conditions severe defoliation and death of the young stems may occur.

The fungus responsible for this disease, which is named *Colletotrichum villosum* n.sp., grows slowly on non-acid media only, maize meal, oatmeal, and 2 per cent. dextrose agars and fresh, green string-bean pods being particularly favourable for conidial production. It is characterized by a white, later dark brown, thick-walled, multiseptate mycelium, amphigenous acervuli, 25 to 100, commonly 30 to 50 μ in diameter, grey to warm or ochraceous-buff conidial masses, hyaline to purple-grey or red-brown, uni- to quadriseptate setae, 45 to 150 by 6·3 to 9·5 (average 85 by 7·5) μ (sometimes absent), and hyaline, unicellular, bluntly tapering conidia, 15 to 24 by 3·5 to 4·5 (18·9 by 4) μ. The minimum, optimum, and maximum growth temperatures are 3·5°, 24° to 26°, and near 32° C., respectively. *V. atropurpurea*, *V. villosa*, and *V. dasycarpa* were the most susceptible of the species tested, *V. sativa*, *V. grandiflora*, *V. monanthos*, *V. angustifolia*, and *V. pannonica* being comparatively resistant. Control measures should be based on the use of healthy seed, crop rotation, and the cultivation of resistant varieties.

VANG (J.). **Typhula species on agricultural plants in Denmark.**—Reprinted from *Aarsskr. VetHøjsk., Kbh., 1945*, 46 pp., 18 figs., 4 graphs, 1945.

The studies under discussion were carried out on herbarium material from the Copenhagen Botanical Museum, fresh field specimens, and pure cultures of *Typhula* spp. from the Centraalbureau voor Schimmelcultures, Baarn, Holland.

J. Lind reported (Danish Fungi, 1913) the following species as of phytopathological importance in Denmark: *T. gyrans* on cabbage, *T. betae* on beet, *T. variabilis*, *T. graminum* on grasses, and *T. trifolii* on clover. The fungus isolated from semi-decayed swede petioles produced brown to black sclerotia, 0·5 to 2 mm. in diameter, with a medulla of prosoplectenchymatous hyphal tissue with large, irregular cells just below the cortex, which is about 12 μ thick, rough, and consists of a gelatinous, quasi-homogeneous layer. The unbranched fruit body is whitish, 1·5 to 2 cm. or more in height, of which one-quarter to one-third is occupied by the fusiform clavula. The basidia are clavate and furnished with four sterigmata, and the ellipsoid basidiospores measure 6 to 9 by 3 to 4 (average 8·1 by 3·3) μ. From the anatomical structure of the sclerotia the author concludes, in agreement with Ruth Remsberg [*R.A.M.*, xix, p. 434], that the *Brassica* pathogen should be referred to

T. variabilis Riess and not, as heretofore, to *T. gyrans* (Batsch) Fr. (*Sclerotium semen* Tode). Further support was lent to this opinion by an examination of the herbarium specimens assigned by E. Rostrup to *T. gyrans*. However, since *S. semen* (1790) is not the oldest name of the fungus, which had already been described as *Lycoperdon brassicae* by Bergius in 1765, it is proposed to re-name it *T. brassicae* (Berg. ex Fr.) n. comb. with *T. variabilis* as a synonym.

The sclerotia of *T. brassicae* germinate with fertile fruit bodies after six months' dormancy under the influence of light. The optimum temperature for mycelial growth was found to be about 16° C. and the maximum 21°, while the sclerotia develop most rapidly just below the optimum. The latter organs occur singly or in small groups in concentric rings round the inoculum. A drop of clear liquid appears on their surface during growth but is no longer perceptible at maturity. The entire period of development occupies from 10 to 12 days. On agar cultures many sterile structures resembling fruit bodies are formed, usually from the sclerotia, though they may arise directly from the adpressed white, later brownish mycelium. They are white, simple or slightly branched towards the apex, phototropic, and up to 8 by 0·5 cm. After ten days a few fertile fructifications developed among the many sterile ones in Petri dishes from a thermostat room, but the former were absent from cultures kept in the dark. Like J. A. MacDonald in Scotland [ibid., xiv, p. 279], the author failed to infect turnips with pure cultures of *T. brassicae*, and his tests on fodder and sugar beets, swedes, carrots, and potatoes were similarly unsuccessful. In Denmark the fungus is most commonly found on swedes and turnips in silos, and may contribute to the spread of decay incidental to defective methods of ensilage, but neither here nor in other northern countries can it be regarded as a dangerous parasite, though reports of severe infection on sugar beets are forthcoming from southern countries, such as Spain [ibid., xii, p. 416], Italy (also on potato) [ibid., viii, p. 597], and the Azores [ibid., vi, p. 80].

T. betae Rostr. [ibid., xiv, p. 548] is also referred to *T. brassicae* on the basis of its sclerotial anatomy and physiological characteristics. It is of common occurrence in Denmark on stored fodder and sugar beets, mostly in association with other fungi, e.g., *Botrytis cinerea* or *Phoma betae*, and bacteria, or under improper ensilage conditions. The fresh material examined consisted of sclerotia from mangold petioles.

Previous investigations on *T. itoana* Imai (*T. graminum* Karst. sensu Erikss. *et al.*) [ibid., xix, p. 434] are reviewed. The writer's experience with the fungus was limited to a temperature test, the results of which agreed with those obtained by Tasugi in Japan [ibid., xiv, p. 568] and Volk in Germany [ibid., xvi, p. 803], the optimum for mycelial growth being about 10°. Growth is stimulated by darkness and high atmospheric humidity. There are few records of damage to grasses by *T. itoana* in Denmark, where the last record of an attack (on wheat) dates from 1923. Ekstrand is of opinion that in Sweden the fungus is often confused with snow mould (*Fusarium nivale*) [*Calonectria graminicola*: ibid., xxv, p. 103], and the same may be true of Denmark.

The supposed connexion between *S. rhizodes* and *T. itoana* has been disproved [ibid., x, p. 191; xviii, p. 34]. The sclerotia of the two fungi and their symptoms on grasses are very similar, but *S. rhizodes* attacks its hosts at a much later stage of growth than *T. itoana*. The former has been collected in Denmark on *Baldingera arundinacea* and *Calamagrostis lanceolata*. Whetzel places it more correctly in *Rhizoctonia*.

T. trifolii Rostr. was found to grow best between 13·9° and 16·1°. Its mycelial development closely resembles that of *T. brassicae*, but its sclerotia, though fewer, are rather larger than those of the foregoing and blacken more rapidly. Like *T. itoana*, it may be connected with the snow mould and so belong to the group of fungi responsible for winter injury [ibid., xviii, p. 299], but there is no reason to regard it as a primary parasite.

Of the 14 species of *Typhula* enumerated by Lind [loc. cit.] as present in Denmark, only the three discussed in this paper are considered to be of economic importance.

BLODGETT (E. C.). **Diseases of small fruits in Idaho.**—*Bull. Ida. agric. Exp. Sta.* 246, 27 pp., 19 figs., 1942. [Received February, 1946.]

This useful compilation presents the available information on the distribution, importance, causes, symptoms, and control of the fungal, bacterial, virus, non-parasitic, and miscellaneous diseases of small fruits in Idaho.

Common fungus diseases of fruit trees in South Australia.—*J. Dep. Agric. S. Aust.*, xlix, 4, pp. 158–161, 4 figs., 1945.

In this paper, the first of a series, compiled by Officers of the Horticultural Branch of the South Australia Department of Agriculture, a simple key is given to the diseases affecting stone fruit trees, followed by brief, practical notes on the symptoms and control of 'curl leaf' (*Taphrina deformans*) and shot hole (*Coryneum beijerinckii*) [*Clasterosporium carpophilum*] of stone fruits.

WILLISON (R. S.). **A line-pattern virosis of Shiro Plum.**—*Phytopathology*, xxxv, 12, pp. 991–1001, 3 figs., 1945.

The line-pattern virosis [peach line-pattern virosis virus] previously observed on Shiro plums [*R.A.M.*, xxii, p. 10] was transferred by budding at the Dominion Laboratory of Plant Pathology, St. Catherines, Ontario, to Shiro, Abundance, Early Golden, Imperial Gage, Reine Claude, Lombard, and Grand Duke plums, Italian and German prunes, myrobalan (*Prunus cerasifera*) seedlings, Elberta, Rochester, and seedling peaches, Niagara apricots, Black Tartarian and Napoleon cherries (*P. avium*), Montmorency cherry (*P. cerasus*), and *P. mahaleb* seedlings. There were considerable variations in the intensity of the symptoms induced, the patterns being virtually absent, for instance, from Early Golden and Imperial Gage plums, barely perceptible and translucent in Italian prunes and Reine Claude, and brilliant yellow to white in Shiro and some *P. cerasifera* seedlings; the relatively few affected leaves on Lombards frequently became necrotic. The inoculated peaches usually developed pale green, irregular lines, rings, and veinbanding, while faint, green rings and lines and yellowish to white patterns were found on Black Tartarian and Napoleon cherries; diffuse, pale streaks, spots, and rings, and slight necrosis on Montmorency in the first season and narrow, translucent lines in the second; green rings and lines and short, yellow, later necrotic streaks along the veins on *P. mahaleb*; and the reactions of apricots were negative.

LOTT (T. B.). **'Lambert mottle', a transmissible disease of sweet Cherry.**—*Sci. Agric.*, xxv, 12, pp. 776–779, 1 fig., 1945.

In 1939 symptoms, previously unobserved but suggestive of mottle leaf, appeared in four experimental Lambert sweet cherry trees in the grounds of the Summerland Laboratory, British Columbia. Surveys of over 9,000 cherry trees revealed only nine Lambert trees with the characteristic symptoms.

The terminal shoots of trees in which the disease is well established appear normal in early spring but, as the season advances, all the upper buds either fail to move, or swell a little and then die. The development of the other leaf buds and of the flower buds is both late and irregular. In early summer, the foliage appears slightly thin, but individual leaves are normal in appearance except that some are below full size. In early June a slight yellow interveinal mottle begins to appear on the older leaves, and is soon followed by numerous small spots of a purplish or chocolate colour which later becomes brown, and forming lines beside the veins and rings without relation to the latter, the spots being surrounded by faint areas of greenish yellow. In addition to these symptoms, and possibly unrelated to them, leaf areas

up to 3 cm. long, which become brown and torn, are observable. In midsummer, the basic normal green of the oldest leaves changes to yellow, and the greenish yellow pattern becomes slightly darker. Premature defoliation, beginning in July, may cause a loss of half the leaves. Branching resulting from new shoots from some way down the previous season's growth is at all times a characteristic symptom. In all these circumstances a light crop results with many fruits failing to reach maturity. The disease becomes progressively more serious for several years, necrosis of the twigs and larger branches occurs, and there are indications that young trees may die prematurely. In older trees the disease, to which the name 'Lambert mottle' is given, appears to become stabilized.

'Lambert mottle' has been transmitted to 17 Lambert trees successfully in every case, six times from Bing tissue and eleven from Lambert tissue. It has also been transmitted to Lambert from a Napoleon source in Nelson containing mottle leaf also and three Lambert sources in the Okanagan valley containing 'Lambert mottle' only; attempts to transmit the disease from these four sources and one other Lambert source to 27 Bing trees and 14 of Napoleon produced no visible effect. Diseased Lambert branches grew in some of these trees for years without showing symptoms. Normal Bing buds set on a diseased Lambert tree produced branches which grew normally till the Lambert tree was nearly dead. Some of the Bing leaves then showed a few rather bright yellow ring spots and 'Lambert mottle' was transmitted to two Lambert trees from buds taken from these Bing branches.

From these and further experiments it is concluded that 'Lambert mottle' and mottle leaf [*R.A.M.*, xxiii, pp. 391, 392] are both transmitted by budding and grafting, the former virus producing marked symptoms on Lambert trees and no visible reaction in Bing or Napoleon; whereas the latter induces pronounced symptoms on Bing and Napoleon and but little effect on Lambert. In double infections the symptoms depend upon the variety, only one disease becoming visible and the other being without effect.

WINTER (A. G.). **Virusartige Erkrankungen der roten Johannisbeeren (Ribes rubrum).** [Virus-like diseases of Red Currants (*Ribes rubrum*).]—*Z. PflKrankh.*, 1, 10, pp. 512–520, 7 figs., 1940. [Received January, 1946.]

For two years prior to the time of writing, red currants in the fruit-growing district of the foothills round Bonn, Germany, were observed to be suffering from a virus-like complex provisionally divisible into two main groups and in no way reminiscent of Hildebrand's mosaic [*R.A.M.*, xviii, p. 536]. Group (1) comprises plants in which (*a*) the long shoots cease growth after the production of a few (6 to 10 instead of the normal 20 to 30) leaves at the beginning to middle of May instead of continuing until mid-June, the cessation of growth being accompanied by a pronounced shortening of the internodes, so that the terminal bud is surrounded by a 'whorl' of three large leaves. Another feature (*b*) of this group is the complete degeneration of the growing point, which presents a flattened appearance, as though cut with a knife, instead of producing a normal bud. Diseased plants (*c*) frequently put out numerous axillary buds from the current season's wood at the beginning of June. The leaves (*d*) are dark green to leaden-grey, hard and leathery, like the pinnate leaves of leaf roll-diseased potatoes. The leaves and petioles (*e*) assume an erect growth habit.

Group (1) may be further subdivided into two types, in one of which (*a*) the stiff growth habit is the most prominent symptom, while (*b*) is characterized in the first place by drastic truncation of the long shoots, dying-off of the terminal bud, and a profusion of axillary buds on the current season's wood. The leaves of plants in which type (*a*) predominates display the most bizarre shapes and the fine, regular dentation of normal foliage is usually lacking, the margin usually being deeply lobate, occasionally smooth or nearly so, while the size of the lamina is generally

much reduced. The colour of the leaves is usually darker than in healthy plants, with a diffuse mosaic, narrow, pale green stripes frequently running alongside the veins, the abnormal paucity of which imparts an abnormal smoothness to some areas of the blade alternating with irregular protuberances. A particularly characteristic feature of the diseased leaves is the absence of the normal tridimensional conformation, which gives them the flattened aspect of pressed specimens, while a further anomaly consists in the quasi-geometrical arrangement on the shoot of the stiffly upward-tending leaves and petioles, in marked contrast to the normal foliage.

In type (*b*) the most striking symptoms are the dark green to leaden grey hue and exceptionally large size of the leaves of the truncated shoots. On the other hand, the foliage of the shoots arising from the above-mentioned axillary buds put out in June are of a sharply contrasting pale green, with a diffuse mottling, and mostly very much malformed.

Group (2) is composed of plants affected by a rare and much less harmful disorder characterized by clearing of the veins and sometimes of the surrounding tissues.

The economic importance of the disease complex should not be underrated, the stiff growth habit and giant foliage of group (1*b*) being specially deleterious. In some of the nurseries inspected, 20 to 40 per cent. of the bushes showed such acute symptoms that only a very poor harvest or none could be expected. Edaphic and other environmental factors being excluded as causes of the pathological syndrome, the source must reside within the plant, probably in the form of a virus.

White (N. H.). **Septoria leaf spot of Currants.**—*Tasm. J. Agric.*, xvi, 4, pp. 153–163, 8 figs., 1945.

A popular account is given of *Mycosphaerella ribis*, causing a leaf spot, especially of black currants, in Tasmania, where it is destructive in certain seasons. Control suggestions include the destruction of all fallen leaves, where possible, as these bear perithecia, and spraying with Bordeaux mixture at 3-3-100 when the fruit is half-grown and again at the same or double strength after picking. The 6-6-100 concentration after picking may cause premature defoliation, though without serious results.

Martyn (E. B.). **A note on Banana leaf speckle in Jamaica and some associated fungi.**—*Mycol. Pap., Imp. mycol. Inst.*, 13, 5 pp., 3 figs., 1945.

The author describes banana leaf speckle (*Chloridium musae*) [*R.A.M.*, xvi, p. 476] as it occurs in Jamaica. The 'rhizomorphs' referred to by Stahel were produced in culture and the size of the spores still attached to the conidiophores, or recently shed, agreed with Stahel's measurements (5 to 8 by $2\frac{1}{2}$ to $3\frac{1}{2}$ μ), but after shedding they increased to 11 to 16 by 3 to 5 μ, reaching in old cultures occasionally up to 21 μ in length, and many became uniseptate. Successful inoculations were carried out both in the field and in the laboratory.

Speckling by *C. musae*, when macroscopically observable, is black or dark brown, and a regularly distributed, pale brownish flecking, caused by another weakly parasitic fungus, may be seen on mature banana leaves in humid areas if the yellowing parts of the leaf are examined closely. Conidiophores, longer and stouter than those of *C. musae*, up to six-fasciculate, bi-to quinque-septate, 60 to 500 by 3·5 to 6 μ, bear on terminal branches catenulate spores, 6 to 22 by 2·5 to 4 μ in diameter, somewhat similar in shape and size to those of *C. musae*. The surface mycelium is not so profuse, distinctive, or widespread as that of *C. musae*, and enters the stomatal apertures less frequently, though some stomatopodia are found. This fungus is described by E. W. Mason as *Cladosporium musae* n.sp., differing as it does from every species of the genus seen in culture in (1) the differentiation between repent mycelium and the conidiophore, (2) the persistent branches at the apex of the conidiophore, and (3) the conidial chains formed on

both differentiated conidiophores and on the undifferentiated mycelium. *Ramichloridium musae* Stahel [loc. cit.] was described as forming conidia singly as in *Chloridium musae*, and is accordingly regarded as distinct.

In the course of examination of banana leaves a peculiar fungus was found constantly growing epiphytically upon the under surfaces, especially near the margins; it is assigned by Mason to a new genus *Zygophiala* and named *Z. jamaicensis* n.sp.

Indagini tossicometriche sugli anticrittogamici. I–X. [Toxicometric researches on fungicides. I–X.]—*Atti Ist. bot. Univ. Pavia*, Ser. 5, i (2), pp. 87–213, 9 figs., 2 graphs, 1943. [Received February, 1946.]

In the introduction (pp. 87–93) to this series of papers based on work begun in 1941 at Florence and continued at the Centre of Fungicidal Studies, Pavia, R. Ciferri discusses in detail the nature of the difficulties involved in the problem and concludes that there are two aspects to toxicometric determinations. One is testing *in vitro* under entirely artificial conditions, which are, however, easy to reproduce and always identical. These conditions give a conventional but uniform basis to the work. This method of testing is always comparative, since it constantly refers to a fungicide-type which serves as 'model' to that being tested. The second method consists of *in vivo* tests under conditions approximating to the natural ones optimum for the development of the disease. Here uniformity is less, but the basis is not conventional. This is an absolute method of evaluation, since it is independent of reference to any fungicide-type.

In the second paper (pp. 94–105), the same writer, reviewing some of the most outstanding work done on the testing of fungicides from the end of the last century up to 1943, expresses the view that the complete study of a fungicide involves: (1) the determination of fungicidal ability *in vitro* in the laboratory in conditions most favourable to the activity of the material; (2) as (1) but under less favourable conditions (generally different, successive dilutions), to determine the limits of efficacy of the material; (3) determination of fungicidal ability *in vivo*, either in the glasshouse or in the open, before the material has been exposed to meteorological conditions; (4) as (3), but after the material has been so exposed and (5) determination of the susceptibility of the fungus to the active principle of the preparation, so as to distinguish between the effect upon it of this principle and the effect of other substances present, the manner of preparation, and the like.

In the third paper (pp. 106–119), R. Ciferri and E. Baldacci, after a detailed discussion of the factors adversely affecting the uniformity of conditions under which laboratory tests of the toxicity of fungicides are carried out, describe an apparatus in which glass slides on a slowly rotating disk driven by an electric motor and covered by a zinc container with an aperture are exposed one at a time to a fine spray of fungicide, which is allowed to fall on them from above by force of gravity. It is claimed that this facilitates correct timing of exposure to the spray (as it is only necessary to count the number of turns of the disk) and also renders the atomization more uniform.

In the fourth paper, R. Ciferri and G. Barbensi give a detailed account of an investigation in which the method of analysis of variance was applied, in studies on the toxicity of fungicides, to a number of factors likely to affect the uniformity of the results obtained in parallel tests, i.e., differences in germination as between one slide and another sprayed at the same time, and between different drops on the same slide, personal errors of the worker, including the fatigue factor, imperfect control of the pressure and duration of atomization, nozzle diameter, and the particular species of fungus used. Recommendations based on the data obtained are made for minimizing these sources of error.

The fifth contribution, by R. Ciferri (pp. 155–156), describes a kind of tally

register by means of which the numbers of germinated and ungerminated spores observed *in vitro* can be recorded with one hand while the observations are being made, the totals of the counts being always visible.

In the sixth paper (pp. 157–159), R. Ciferri states that as a means of checking the atomization by hand of glass slides in *in vitro* tests of copper fungicides, he places the slides to be sprayed on paper treated with a solution of 2 gm. pure potassium ferrocyanide with 2 c.c. pure concentrated nitric acid in 100 c.c. water [cf. Blodgett and Mader: *R.A.M.*, xiii, p. 587]. The slides are sprayed in the ordinary way and drops falling on to the treated paper leave a brown stain. In this way, it is easy to judge by eye of the regularity and intensity of the spray.

In the seventh paper (pp. 160–167), R. Ciferri, G. Gallina, and E. Baldacci express the view that in evaluating the toxicity of a fungicide it is essential to take into consideration in every test the percentage of non-germination in water and that in some standard fungicide, such as Bordeaux mixture. To say that a given fungicide results in '60 per cent. non-germination' is of doubtful value, if there is only 10 per cent. non-germination in water and 95 per cent. in Bordeaux mixture. To arrive at a reliable figure, subtraction should be made from every 100 spores of the 15 whose behaviour is independent of the fungicide being tested (i.e., the 10 that do not germinate in water and the 5 that germinate in Bordeaux mixture). There remain 85 spores, of which, say, 30 do not germinate in the given fungicide. Toxicity is therefore equivalent to the killing of $\frac{30}{85}$ of the spores, or 35·29 per cent. Generalizing this, if $\frac{m}{100}$, $\frac{a}{100}$, and $\frac{n}{100}$ are the percentages of non-germinated spores in water, the tested fungicide, and Bordeaux mixture, respectively, then the percentage non-germination actually due to the fungicide is given by the formula $x = 100\frac{a-m}{n-m}$. If $m = 10$ and $n = 95$, the following figures are obtained: actual percentages of non-germination, 10, 20, 30, . . . 95, and corresponding adjusted percentages, 0, 11·76, 25·53, . . . 100.

The paper concludes with notes on tests of the average germinability of the conidia of an *Alternaria* of the *A. tenuis* type in water, Bordeaux mixture, and Caffaro powder.

In the eighth paper (pp. 168–177), R. Ciferri, G. Barbensi, and E. Baldacci, using the formula $\chi^2 = \frac{N(ad-bc)^2}{(a+b)\ (c+d)\ (b+d)\ (a+c)}$, compile a table of indices from which the toxicity of any fungicide can be immediately found after observation of the number of spores that germinate when 100 spores have been treated by it, relatively to germination in water (toxicity nil) and in Bordeaux mixture (maximum toxicity). It is assumed that germination (g) in water is 90 spores and non-germination (ng) 10, while in Bordeaux mixture g is 5 and ng 95, 100 spores being used each time. The index is arrived at by using $\chi_1^2 - \chi_2^2$, which gives a figure ranging from $-144·86$ to $+144·86$. This, at the maximum, gives a new index ranging from -1 to $+1$, which can be regarded as a good criterion of toxicity. The index increases as χ_1^2 becomes greater, that is as toxicity becomes more marked, and intermediate values can be found by interpolation. This gives a table in which when g is 90, 85, 80, . . . 50, . . . 5, and ng 10, 15, 20, . . . 50, ... 95, χ_1^2 is 0·00, 1·14, 3·63, . . . 38·10, . . . 144·86, χ_2^2 is 144·86, 129·29, 115·08, . . . 51·26, 0·00, and $(\chi_1^2 - \chi_2^2)$ 144·86 is $-1·00$, $-0·88$, $-0·77$, . . . $-0·09$, . . . 1·00.

The value -1 corresponds to a germination or non-germination equal to that in water, i.e., toxicity nil; the value $+1$ corresponds to a germination or non-germination equal to that in Bordeaux mixture, i.e., maximum toxicity; and the value 0 corresponds to a toxicity of half the maximum.

In the ninth contribution (pp. 178–202), R. CIFERRI and L. CAVALLI discuss from the mathematical point of view the evaluation of the toxicity of fungicides by the method of the 'straight line of action' of Prigge and Schaefer, with special reference to the interpretation of the curve of action and the method of rectification, the use of graphic methods, random sampling, general rules for the application of the straight line of action, the case of non-rectifiable curves, and their theoretical significance and elaboration in practice.

In the tenth contribution (pp. 203–212), R. CIFERRI discusses methods used by himself and other workers for testing the 'collateral characteristics' of fungicides, i.e., the qualities other than fungistatic and fungicidal that they possess, including adhesiveness and residual fungicidal ability (fungicidal and fungistatic power remaining after exposure to meteorological conditions), behaviour in suspension, and wettability.

Indagini tossicometriche sugli anticrittogamici. XI–XXII. [Toxicometric researches on fungicides. XI–XXII.]—*Atti Ist. bot. Univ. Pavia*, Ser. 5, v (1), pp. 3–187, 1 pl., 2 figs., 3 diags., 18 graphs, 1944. [Received February, 1946.]

In the eleventh paper of this series (pp. 3–18) and the first in the present volume [see preceding abstract], R. CIFERRI and E. BALDACCI give a full account of *in vitro* tests of the relative toxicity of various metallic salts to an *Alternaria* of the *A. tenuis* group and to *Plasmopara viticola*. The results obtained indicated that copper, silver, and mercury were of very high, cadmium of high or medium, and zinc of very slight, toxicity.

In the twelfth paper (pp. 19–30), L. CAVALLI and R. CIFERRI deal with the mathematical evaluation of the toxicity of fungicides, with reference to analysis of the distributions of frequency of the percentages of non-germination, based on observations on about 290,000 conidia of *A. tenuis* group. The work done, which is not yet fully completed, is discussed in detail.

In the thirteenth paper (pp. 31–37), R. CIFERRI describes a mathematical method of checking the accuracy of laboratory tests of the toxicity of fungicides. He concludes that (1) in testing *in vitro* the fungicidal power of a given preparation on *A. tenuis* group, conidia of normally developed colonies may be used up to the age of one month, after which the exactitude of the results begins to decline; (2) cultures grown at a temperature much above the optimum, i.e., at 30° C. instead of 20° to 21°, are less reliable than those grown at the optimum; (3) the inexactitude of the test becomes appreciable if the cultures are contaminated by extraneous organisms; (4) a density of conidial suspension in the hanging-drop culture double that normally used reduces the exactitude of the test, while a density four times the normal still further reduces it; (5) the optimum temperature for the germination of the conidia is between 20° and 26°; (6) the optimum time for counting the germination is after 24 hours; after 12 or 48 hours the results are less accurate, after 72 still less, and after six hours still less again.

In the fourteenth paper (pp. 38–58), R. CIFERRI and E. BALDACCI give a detailed account of tests of the fungicidal effect of citric acid and tartaric acid in copper mixtures carried out in hanging-drop cultures on conidia of *A. tenuis* group. The immediate fungicidal ability of citric acid and tartaric acid was very small in the concentrations of 'ramital' [Casale's mixture: *R.A.M.*, xxii, pp. 52, 287] used, and it is probably small in other materials. The most salient effect shown was a marked acceleration of the absorption of copper by the fungus in very dilute solutions, particularly after 20 to 45 minutes' contact. In copper sulphate, the fungus suddenly began to absorb appreciable quantities of copper between the 45th and 60th minute, whereas in the presence of citric acid and tartaric acid, absorption was more uniform and began between the 10th and 25th minute. At the 45th

minute, in these conditions, the cell was experiencing fully the fungistatic and partly fungicidal effect of the copper ions.

In the fifteenth paper (pp. 59–80), R. Ciferri and E. Baldacci present evidence showing that a zinc salt exerts an effective anti-germinative potentializing power when added to a copper salt of equal anion, but only in solutions of the salts themselves and at the critical threshold of toxicity.

In the sixteenth paper (pp. 81–92), E. Baldacci and R. Ciferri describe experiments the results of which indicated that oxyquinolin derivatives exert a potentializing effect on the fungicidal efficiency of certain copper and zinc salts.

In the seventeenth paper (pp. 93–111), R. Ciferri and E. Baldacci, describing laboratory experiments on the use of lime as a fungicide, conclude that milk of lime is not likely to prove of practical value in the control of *Plasmopara viticola.*

In the eighteenth paper (pp. 112–129), R. Ciferri describes a method of determining the behaviour of fungicides in suspension by measuring the velocity of sedimentation by means of a photo-electric cell.

In the nineteenth paper (pp. 130–144), E. Baldacci and R. Ciferri give full details of a method of determining the immediate preventive effect of a fungicide on vines artificially infected with *P. viticola* in the greenhouse, i.e., immediately the material has been sprayed on to the leaves and before it becomes affected by meteorological factors.

In the final papers (pp. 145–186), V. Gallo and E. Baldacci deal with the quantitative evaluation of the toxicity of fungicides tested under *in vivo* conditions, E. Baldacci treats of the biology of *P. viticola* in glasshouse inoculations, and L. Cavalli describes a method of interpolation of curves of action of plant protectives.

Mulder (D.). **Biologisch onderzoek van grondontsmettingsmiddelen.** [Biological investigation of soil disinfectants.]—Thesis, Univ. Amsterdam, 114 pp., 12 figs., 3 graphs, 1943. [English and German summaries. Received November, 1945.]

Following a review of the literature on soil disinfection by chemical methods, in connexion with which the paucity of systematic laboratory studies in this immense field is emphasized, the author fully describes and tabulates his experiments with a number of inorganic and organic compounds against *Pythium debaryanum*, *Rhizoctonia solani graminis*, *Fusarium culmorum*, and *Trichoderma lignorum* [*T. viride*]. The *dosis toxica* in relation to the fungi and the *dosis tolerata* for seedlings were determined in order to compute the chemotherapeutical index, the growth of *P. debaryanum* in a plain 0·5 per cent. saccharose solution serving as a criterion of toxicity, while garden cress (*Lepidium*) [*sativum*] and other seedlings grown on nutrient solutions supplied material for the estimation of the effects of the fungicides on the hosts. In adsorption tests the mycelial growth of *P. debaryanum* afforded a much more accurate means of ascertaining the concentration than chemical methods. A low and therefore favourable index figure in the laboratory, however, does not necessarily coincide with adequate disinfectant properties in the ground; the latter are influenced by different factors from those operating in *in vitro* trials, notably the adsorption of the compound in the soil, whereby its efficiency decreases. In tests in garden soil and adsorbent coal the phenyl mercury compounds were adsorbed ten times as strongly as those of ethyl mercury.

Optimum conditions for damping-off were provided by a closed experimental chamber with natural lighting maintained at a temperature of 25° to 30° C. In greenhouse tests with spinach at 20° to 25° soil humidity was shown to exert a decisive influence.

Absolute disinfection was secured only by treatment with 4 per cent. formalin solution, but a dust consisting of a mixture of formalin and infusorial earth or

sawdust gave almost equally good results. The mercury compounds were also shown to be applicable in the dry state. Promising results were further obtained with cuprous and zinc oxide dusts as soil and seed disinfectants for the control of pre- and post-emergence damping-off.

TILEMANS (E.) & MARTENS (P. H.). **Contribution à l'analyse des produits phytopharmaceutiques. I. Considérations sur l'analyse en phytopharmacie.** [A contribution to the analysis of plant-protective products. I. Considerations on analysis in plant protection.]—*Parasitica*, i, 3, pp. 102–105, 1945.

After referring to the greatly increased numbers of plant-protective products that have come into use in the last ten years, the authors point out that analysis of some of these materials raises complex problems; their physical properties are sometimes as important as the amount of active substance present, and have to be determined by physico-chemical methods. Furthermore, analysis of a plant-protective product also involves biological tests. At the official research station, Gembloux, Belgium, the plant-protection section has been commissioned to examine and test every anti-parasitic product made or sold in Belgium, and all known methods of test are being applied to this end.

YARWOOD (C. E.). **Copper sulphate as an eradicant spray for powdery mildews.**—*Phytopathology*, xxxv, 11, pp. 895–909, 9 graphs, 1945.

The experimental demonstration that the eradicant value of Bordeaux mixture for the control of bean [*Phaseolus vulgaris*] powdery mildew (*Erysiphe polygoni*) decreased with rising proportions of lime in the spray [*R.A.M.*, xxiii, p. 182] prompted this further study on copper sulphate as a fungicide for the disease in question and others of the same group.

The addition of a spreader, glyceryl alkyl resin (B 1956, Rohm & Haas Co.), to water sprays decreased the deposit on the under sides of cantaloupe and bean leaves from 2·6 to 1·25 and from 1·5 to 0·5 gm. per sq. dcm., respectively, but increased the coverage.

The extent of injury from blue stone [copper sulphate] spray was measured on foliage of field- or greenhouse-grown plants of bean, cucumber, cantaloupe, beet, grape, pea, hops, mustard, potato, tomato, rose, and apple. The concentration of copper sulphate required to cause 50 per cent. damage ranged from 0·035 per cent. for mustard to over 10 per cent. for beet. The addition of a spreader usually mitigated the injury from copper sulphate, but in the case of greenhouse beans it increased the damage from Bordeaux. To produce a 50 per cent. injury to bean about ten times as much copper was necessary in the form of Bordeaux as in that of copper sulphate.

The eradication of bean powdery mildew was effected at minimum copper dosages with copper sulphate plus spreader. Thus, for 95 per cent. eradication a spray containing about 0·04 per cent. copper sulphate plus spreader was requisite, while to achieve a comparable effect about 2·4 times as much copper was needed in the form of copper sulphate without spreader and 6·4 and 18 times as much, respectively, in that of Bordeaux with and without spreader. On the basis of maximum control and minimum injury, 0·06 per cent. copper sulphate plus spreader was the most effective treatment, followed in descending order by 0·4 per cent. Bordeaux plus spreader, 0·8 per cent. of the same without spreader, and 0·08 per cent. copper sulphate without spreader. The other soluble coppers, copper chloride, copper nitrate, and copper acetate, appeared to be about equal to copper sulphate as eradicant sprays, but those of the insoluble class, including (besides Bordeaux) Burgundy mixture, cuprous oxide, basic copper sulphate, copper oxychloride, and copper carbonate, were decidedly less effective. Copper sulphate plus spreader also proved superior to several other non-sulphur and non-copper chemicals tested.

Conidia of *E. polygoni* from bean and mustard germinated well (17 and 28 per cent., respectively), on the surface of 10 per cent. copper sulphate solutions, suggesting that *in vitro* tests of the effect of chemicals on spore germination are of little value in the appraisal of their practical fungicidal properties.

The spray concentration requisite for 95 per cent. eradication of bean and cucumber powdery mildews decreased from a maximum of 0·3 per cent. copper sulphate applied at the time of inoculation to 0·03 per cent. a week later. Lower concentrations were necessary to control the disease on beans during the daytime than at night.

Heavier dosages of most sprays were required for protection than for eradication, about 100 times as much copper sulphate, for instance, being necessary for 95 per cent. control in a protective as in an eradicant application.

The green weight of foliage and the fruit yield on bean, cucumber, and cantaloupe plants on which powdery mildew was combated with eradicant treatments of copper sulphate plus spreader in greenhouse and field trials exceeded that obtained from comparable unsprayed plants.

PETTEY (F. W.). **Biological control of Prickly Pear.**—*Fmg S. Afr.*, xxi, 238, pp. 31–33, 1946.

In this further account of the biological control of prickly pear (*Opuntia* sp.) [cf. *R.A.M.*, xxi, p. 33] in South Africa the author states that one of the insects used in the campaign, the cochineal insect (*Dactylopius opuntiae*), has recently been attacked in coastal and non-Karoo areas by a species of *Empusa* [cf. ibid., xxiv, p. 402].

Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, lvi, 12, pp. 537–540, 2 figs., 1945.

Brief, practical directions are given for seed treatments against fungal diseases of plants by means of hot water, liquid chemicals, and dusts, with instructions for making a simple apparatus for hot-water treatments.

KLEMM (M.). **Ernteverluste, Schadensschätzung und Pflanzenschutzstatistik.** [Crop losses, estimation of damage, and plant protection statistics.]—*Forschungsdienst*, x, 3–4, pp. 265–275, 1940. [Received January, 1946.]

This paper contains many interesting observations on the statistical aspect of plant protection, among which the following may be mentioned. It is essential to distinguish between the indirect and the direct effects of crop losses, the former including, for instance, a fall in the purchasing power of the agricultural population and the increased expenditure incurred through the need for replacement of the missing produce from extraneous sources, while the latter relate solely to the harvest reductions from a given pathogenic agency. Actual losses (representing the unredeemed values of the decimated crop, costs of control measures, outlay for replanting, and the like) must also be differentiated from potential losses, while yet another line must be drawn between avoidable losses and those against which control measures are at present impracticable for economic or technical reasons.

Crop loss statistics may serve different purposes. For instance, if the importance of cultivated crop pests in the national economy is to be considered, the sum-total of the actual (direct and indirect, avoidable and unavoidable) harvest reductions must be computed. For an estimate of the economic significance of plant protection, data relative to the potential damage, in the absence of control measures, should form the criterion. A decision as to the outlay of money and labour in the execution of plant-protective operations should be based exclusively on actual avoidable and direct losses, whereas unavoidable reductions are also of interest in propaganda for the study of plant protection. In most of the published statistics on crop losses it is hardly possible to determine which of the differential categories is involved; hence no doubt the immense discrepancies in the estimates.

The statistical method of appraisal of crop losses from disease is based on the study of as large a number as possible of reports of the plant protection intelligence service from different parts of the country. The analytical method, involving the determination of the distribution, incidence, and persistence of the parasites and of the regions subject to repeated intensive attacks, and a study of the interrelationships of the pathogens, affected areas, and environmental factors (economic, climatic, biological, and edaphic), demands specially trained assistants and is applicable only in special cases and within narrow limits. The principal sources of error in the computation of crop damage lie in the wide local and seasonal variations in growth conditions; the varying reactions of plants to a given pathogen according to their stage of development, age, species, or variety; nature and number of pathogens, time of occurrence, environmental requirements, and the like. Exaggeration of the damage caused by parasitic agencies is a more common fault than under-estimation of their importance.

The most important plant parasites may be grouped in the following categories: (*a*) precluding the cultivation of a particular crop in a given locality without constant control measures, e.g., potato wart [*Synchytrium endobioticum*], elm die-back [*Ceratostomella ulmi*]; (*b*) sporadically destructive of certain crops, such as potato late blight [*Phytophthora infestans*] (epidemic in Germany in 1916), cereal black rust [*Puccinia graminis*] (Silesia, 1932), and Douglas fir [*Pseudotsuga taxifolia*] blight [*Phaeocryptopus gaeumanni*]; (*c*) occasionally responsible for heavy losses in certain districts, e.g., potato scab (*Actinomyces scabies*); (*d*) generally of moderate intensity, but at times severe or widespread in a mild form such as cereal yellow rust [*Puccinia glumarum*] and smuts [*Ustilago* spp.]; and (*e*) mostly unimportant, like cereal foot rots [*Fusarium* spp., *Ophiobolus graminis*, and *Leptosphaeria herpotrichoides*] and ergot [*Claviceps purpurea*].

Bush (M. T.), Goth (A.), & Dickison (H. L.). **Flavicin II: an antibacterial substance produced by an Aspergillus flavus.**—*J. Pharmacol.*, lxxxiv, 3, pp. 262–277, 1 fig., 1945.

The present report deals mainly with progress in the production and purification of flavicin, originally described (*J. Pharmacol.*, lxxviii, pp. 164–169, 1943) as an impure, penicillin-like, relatively non-toxic, anti-bacterial substance elaborated by a strain of *Aspergillus flavus*. The chemical and antibiotic properties of flavicin are stated to be very similar to those of penicillin.

Furtado (A. Da R.). **Pesquisa da atividade antibacteriana com 180 amostras de Aspergillus Micheli, 1729.** [Investigation on the anti-bacterial activity of 180 strains of *Aspergillus* Micheli, 1729.]—*Mem. Inst. Osw. Cruz*, xli, 2, pp. 205–222, 1944. [English summary. Received February, 1946.]

Of 180 strains of *Aspergillus* investigated at the Oswaldo Cruz Institute, Rio de Janeiro, for their anti-bacterial activity, 25 totally inhibited the growth of the test organism, *Staphylococcus aureus*, 32 caused partial suppression, and 123 were quite inactive [cf. *R.A.M.*, xxii, p. 13]. Among the species giving positive results were *A. sydowi*, *A. oryzae*, *A. repens*, and *A. parasiticus*, but in a number of cases discrepancies occurred in the results obtained with different strains of the same species, or at the two assays, one after six and the other after twelve days of growth.

Velu (H.), Comandon (J.), De Fonbrune (P.), & Janot (M. M.). **Pléomorphisme du Penicillium notatum et potentialité antibiotique.** [Pleomorphism of *Penicillium notatum* and antibiotic potentiality.]—*C. R. Acad. Sci., Paris*, ccxxii, 7, pp. 406–408, 1946.

Two strains of *Penicillium notatum*, namely, 4222 from the Lister Institute and 1249 from the Northern Regional Research Laboratories (United States) [*R.A.M.*,

xxv, pp. 129, 130], showed a strong tendency to pleomorphism, reversible only with great difficulty, which impaired or entirely suppressed their bacteriostatic activity.

SARDIÑA (J. R.). **Enfermedades de la Patata.** [Potato diseases.]—*Publ. Estac. Fitopat. Agríc. Coruña* 5, viii+111 pp., 11 pl. (3 col.), 37 figs., 1945.

This useful compilation comprises summaries of the essential information concerning the terminology, geographical distribution, symptomatology, etiology, morphology, pathological anatomy, environmental relations, and control of the following diseases affecting the potato crop in Spain: black leg (*Bacillus phytophthorus*) [*Erwinia phytophthora*], bacterial wet rot of the tubers (*E. phytophthora* and other organisms), actinomycosis or common scab (*Actinomyces scabies*), late blight (*Phytophthora infestans*), *Rhizoctonia* [*Corticium*] *solani*, early blight (*Alternaria solani*), dry rot (*Fusarium caeruleum*, *F. solani*, and *F. trichothecioides*), leaf roll, virus X, virus Y, virus A, and virus F [potato aucuba mosaic virus], internal rust spot, darkening of tubers on cooking in consequence of rough handling in packing or transport [*R.A.M.*, vi, p. 632; xxiii, pp. 40, 76, *et passim*], black heart, hollow heart, and other disturbances of physiological origin. A number of diseases not hitherto reported from Spain, and two doubtful records (*Bacterium* [*Corynebacterium*] *sepedonicum* and *Pseudomonas* [*Xanthomonas*] *solanacearum*), are also included. The concluding chapter deals with control measures in general, and a key for the identification of the principal diseases by their symptoms on the tubers, foliage, and stems is appended.

The functions of the National Service of Seed Potato Production, established by a Decree of 6th December, 1941, are regulated by an Order of the Ministry of Agriculture of 16th May, 1942. The stock falls into two classes, one designated as 'authorized for seed', and the other 'selected for seed'. The latter alone confers an official guarantee of freedom from disease, and is accompanied by a State certificate. An account is given of the methods adopted for the development of élite planting material.

DEL CAÑIZO (J.) & SARDIÑA (J. R.). **Enfermedades y alteraciones de las Patatas.** [Diseases and abnormalities of Potatoes.]—39 pp., 20 col. pl., Estación Central de Fitopatología Agrícola, Madrid, 1944. [Received March, 1946.]

This booklet presents an outline of the available information concerning some well-known diseases of parasitic and physiological origin and insect pests affecting the potato crop in Spain.

QUANJER (H. M.). **Rhizoctonia-ziekte in Aardappelen en bemesting.** [*Rhizoctonia* disease in Potatoes and manuring.]—*Tijdschr. PlZiekt.*, xlvi, 5, pp. 175–176, 1940. [Received February, 1946.]

There are conflicting reports in the relevant literature concerning the effects of stable manure on the incidence of *Rhizoctonia* [*Corticium*] *solani* in potatoes [*R.A.M.*, iv, p. 632; viii, p. 664; xviii, p. 612], which the author attributes to the varying degrees of freshness of the material applied. Probably the decisive factor is the large-scale production in fresh manure of carbon dioxide, which acts adversely on the potato shoots but not on the fungus. Observations along these lines were made by Lundgårdh in connexion with cereal fusarioses [ibid., ii, p. 382], and it is suggested that the potato *Rhizoctonia* problem might be similarly approached with fruitful results.

HUTTON (E. M.) & BALD (J. G.). **The relationship between necrosis and resistance to virus Y in the potato. 1. Greenhouse results.**—*J. Coun. Sci. industr. Res. Aust.*, xviii, 1, pp. 48–52, 3 pl. (following p. 84), 1945.

In breeding work on resistance of potatoes to virus Y carried out at Canberra, two crosses, Snowflake × Katahdin and Brown's River × Katahdin, were made in

1941, while at the same time the Katahdin variety was selfed. Small tubers from the resulting seedlings were planted in the greenhouse, and inoculated in November, 1942. Seedling reactions to inoculation were promising, and among the group of hybrids finally retained for study were three types of necrotic action (unaccompanied by mottling) which appeared promising as a basis for resistance to virus Y. Hybrid 48 after inoculation became severely necrotic, and developed a severe leaf-drop streak resulting in total collapse in a month. Hybrid 106 rapidly developed top necrosis, resulting in collapse of the growing point. With both, reaction on the inoculated leaves after 10 days was severe, resulting in severe necrosis, yellowing, and leaf drop. With hybrid 404, relatively small, localized, necrotic lesions developed rapidly on the inoculated leaf, sometimes, but not always, followed by leaf drop. That these three types of necrotic reaction constitute a protective barrier against virus Y under greenhouse conditions was demonstrated by the fact that tubers from infected plants produced either healthy plants or small, severely necrosed plants which died soon after they emerged. Also, these hypersensitive hybrids, when grafted with an Epicure scion containing virus Y, reacted with severe top necrosis in 14 days.

During the winter in the greenhouse many hybrids gave reactions to Y confined to the inoculated leaves. Tubers from the inoculated plants gave plants free from Y. That false results can be obtained under winter conditions was demonstrated when these hybrids were tested again in early summer, when many had to be discarded because of unsatisfactory reactions. Atypical results also occur when very young or weakly growing plants are used for testing, the reaction with these always being more severe, sometimes with suppression of the mottle.

Selfing or intercrossing the hypersensitive hybrids results in at least one-third of the seedling progeny showing promising reactions to Y. Crossing hypersensitive hybrids with potato varieties possessing the typical rugose mosaic reaction to Y gives approximately 5 per cent. seedling progeny with valuable necrotic reactions to the virus.

Hutton (E. M.). **The relationship between necrosis and resistance to virus Y in the Potato. 2. Some genetical aspects.**—*J. Coun. sci. industr. Res. Aust.*, xviii, 3, pp. 219–224, 1945.

After stating that earlier work by Hutton and Bald having demonstrated that it is possible by hybridization to increase the intensity and speed of the necrotic reactions to virus Y found in some potato varieties [see preceding abstract], building up a sensitive reaction like that of the Epicure variety to viruses X and A, the author describes 15 Y-hypersensitive phenotypes. These, and those obtained from selected crosses and selfings fall into three classes, the local necrotic, top necrotic, and the necrotic collapse, of which the first two are perhaps the most valuable.

Of the potato varieties grown in Australia, Snowflake, Katahdin, and Brown's River appear to show more promise as a source of Y-hypersensitivity than Bismarck, Delaware, Factor, and Sebago.

When hypersensitive types have been selected from hybrid progeny, crosses involving them can produce 10 to 30 per cent. hypersensitive seedlings.

Inheritance of Y-hypersensitivity appears to be due to a recessive allele or alleles, tolerance of the virus being the dominant condition.

Bald (J. G.) & Oldaker (C. E. W.). **Reactions of Tasmanian Bismarck and Brownell potatoes to the commoner virus diseases.**—*J. Coun. sci. industr. Res. Aust.*, xviii, 3, pp. 209–218, 3 pl. (facing p. 276), 1945.

A description, intended to assist inspectors and field workers, is given of the symptoms of viruses X, A, and Y, and of leaf roll on Bismarck and Brownell potatoes, which are exported from Tasmania to New South Wales [cf. *R.A.M.*, xxiv, pp. 92, 403].

On Bismarck virus X produces symptoms noticeable only after very careful examination, A causes formation of light-coloured areas with nebulous boundaries centred on the veins, with sometimes slight distortion of the leaf. Virus Y is less important on Bismarck than X and A, but when it does develop the symptoms are more serious than those of crinkle due to X plus A, though it attacks much fewer plants. Bismarck is very resistant to leaf roll, but when the plants are attacked they become severely dwarfed and bushy.

All Brownell plants carry X, but are field-immune from A; reactions to Y take the form of leaf-drop streak and rugose mosaic, the disease being composite (X+Y). Brownell is, except for Up-to-Date, the most susceptible to leaf roll of the commonly grown Australian varieties, and the virus is the main cause of degeneration in this variety.

The paper concludes with a section on the diagnosis of virus infection in these two potato varieties.

Sukhorukov (K.) & Kling (E.). **Influence of copper upon the Potato plant.**—*C. R. Acad. Sci. U.R.S.S.*, N.S., xlvii, 6, pp. 436–438, 1945.

Leaves from potato plants treated with copper and inoculated with a highly virulent suspension of the conidia of *Phytophthora infestans* showed after four days a poor growth of mycelium of the fungus, with slight formation of conidia and sharply delimited, dark necroses to the extent of 30 per cent. of the leaf, whereas the controls showed 100 per cent. darkening of the whole leaf, with good growth of mycelium and normal conidial formation. Further experiments showed that, while the growth of *P. infestans* was stimulated in culture by the presence of 0·125 per cent. copper and depressed by stronger solutions, peroxidase activity [*R.A.M.*, xix, p. 300] was greater in the copper-treated leaves than in the controls (in the proportion of 18·1 to 12·2). Potato species and varieties immune from *P. infestans* showed a higher peroxidase activity than susceptibles, and the authors believe that copper does not only protect the plant directly by its toxic action but indirectly through a change induced in the physiological properties of the plant.

Black (W.). **Inheritance of resistance to blight (Phytophthora infestans) in Potatoes: unbalanced segregations.**—*Proc. roy. Soc. Edinb.*, Ser. B, xlii, Part II (No. 20), pp. 171–181, 2 figs., 1945.

In continuation of his studies of the inheritance of resistance to two strains, A and B, of *Phytophthora infestans* in derivatives of the triple hybrid (*S*[*olanum*] *rybinii* × *S. demissum*) × *S. tuberosum* and in hybrids descended from *S. demissum* × *S. tuberosum* [*R.A.M.*, xxv, p. 73], the author examined a number of progenies bred from selections in the first back-cross generation of the triple hybrids for their reaction to the A strain. Additional data on blight inheritance were secured from multiple hybrid material originating from the work of the late Dr. Wilson of St. Andrews.

The evidence obtained indicates that resistance is controlled by major and minor genes. On the former depends the major reaction, i.e., resistance or susceptibility; the latter determine the degree of susceptibility in susceptible varieties or act as unidentifiable modifiers in resistant varieties.

Segregation of resistant and susceptible plants in the progenies showed a consistent excess of recessive individuals compared with the standard ratios 1 : 1, 3 : 1, and 15 : 1.

The excess of recessives may be due partly to chromosome homologies leading to multivalent formation and double reduction. In the material used, the excess was largely due to the differential compatibility of gametes arising from residual incompatibility factors associated with the original 'wild' material.

Sleeth (B.). **Agar medium and technique for isolating Pythium free of bacteria.**—*Phytopathology*, xxxv, 12, pp. 1030–1031, 1945.

The usual laboratory methods having proved ineffectual for the isolation of *Pythium* [*ultimum*] in a pure state from guayule [*Parthenium argentatum*] seedlings in California [*R.A.M.*, xxv, p. 43], the following technique was substituted with highly satisfactory results. A medium consisting of 10 gm. dextrose, 2 gm. ammonium acid phosphate, 1 gm. each potassium nitrate and magnesium sulphate, 25 gm. agar, and 1,000 c.c. distilled water was poured into a Petri dish (9 cm. in diameter) and divided into quarters, in the centre of each of which a particle of diseased tissue or soil was placed. Three of the segments were transferred in an inverted position to separate Petri dishes and the fourth left, also inverted, *in situ*, care being taken that the agar completely covered the inoculum. The presence of the pathogen in the inoculum was indicated by the appearance of hyphae on the surface within 24 hours at laboratory temperature, and transfers from the tips usually resulted in pure cultures. When reisolations were made from diseased seedlings, the fungus was frequently obtained in an uncontaminated condition in over 90 per cent. of the tests.

White (D. G.). **An electrometric method for defining the area of bark affected by tapping Hevea brasiliensis.**—*Plant Physiol.*, xxi, 1, pp. 102–108, 2 figs., 1946.

Modern practice in tapping the bark of *Hevea* rubber trees often utilizes two cuts on the same tree, which frequently set up reciprocal interference, while separation of panels by an arbitrary distance often leads to disappointing yields, and further, in many cases, to brown blast, responsible on some plantations for rendering 80 per cent. of the trees untappable. With a view, therefore, to avoiding these inconveniences, the author has devised an electrometrical apparatus by means of which it is possible within reasonable limits to define the area of bark influenced by tapping, by estimating the resistance to an electric current exerted by the bark tissues and cell contents, including the latex, at intervals below the tapping incision.

The apparatus consisted of terminals made from discarded hypodermic needles, shortened to within ½ in. of the shoulders, the ends being squared off and sharpened. The bark was punctured firmly at right angles by the needles until the woody tissues were reached. Two terminals were established 1 in. apart horizontally, with other pairs spaced 6 in. apart vertically. Bark tissue resistance to a relatively weak electric current was measured in ohms, using the Bouyoucos bridge method, in which 6-ft. radio-wire leads with spring clamps attached to the terminals assure rapid operation. By this device it was possible to estimate the effect of tapping low-yielding seedling trees with a half-circumference cut. The effect was slight at 18 in. and nil at 24 in. below the tapping cut.

Wager (V. A.). **Compost and disease.**—*Proc. S. Afr. Sug.* (*Tech.*) *Ass.*, *1945*, pp. 85–90, 5 figs., 1945.

The author subjects to severe criticism the claims made in recent propaganda concerning the use of compost in controlling disease (Sir Albert Howard: An agricultural testament, 1940), and gives data from experiments with compost prepared by G. C. Dymond [*R.A.M.*, xxiv, p. 290] on bacterial wilt (*Bacterium* [*Xanthomonas*] *solanacearum*) and eelworm (*Heterodera marioni*) of tomatoes in support of his views.

Watson (S. J.) & Smith (A. M.). **The trace elements in plant and animal nutrition.**—*Scot. J. Agric.*, xxv, 4, pp. 203–212, 1946.

After an introductory discussion of the part played by trace elements in plant nutrition, the authors give short, practical notes on the symptoms and control of iron, magnesium, boron, manganese, copper, and zinc deficiency in plants. Field

diagnosis of these conditions is complicated in some cases by the antagonism of two or more elements, by the effects of environment, and by damage caused through insects or disease. Visual observation is, therefore, a difficult matter, and a reliable diagnosis can, in many instances, be made only by experienced investigators in possession of laboratory facilities.

In Scotland, grey speck of oats [manganese deficiency: *R.A.M.*, xxii, p. 428] and 'raan' of turnips [brown heart, or boron deficiency: ibid., xx, pp. 390, 616] have been rather prevalent in some areas, while a few cases of magnesium deficiencies in tomatoes and *Brassicae* have also occurred.

NIEDERHAUSER (J. S.). **The rust of greenhouse-grown Spearmint, and its control.**—*Bull. Cornell agric. Exp. Sta.* 263, 30 pp., 6 figs., 1945.

Greenhouse-grown spearmint (*Mentha spicata*) in the north-eastern United States becomes almost a total loss in seasons of severe infection by rust (*Puccinia menthae*). The leafy shoots show poor growth after invasion by the rust mycelium, and usually only one cutting has been made before the disease develops seriously, whereas from healthy plants four to five cuttings can be made during the winter season. Leaves bearing the uredosori or teleutosori of the rust are generally considered unmarketable; tedious sorting of these is required after the mint is cut and the saleable crop thus reduced even further. Bed-space occupied by rusted spearmint is lost at least for a month, and sometimes for two or three months, when profitable crops might have been growing there. Successive annual losses put several greenhouse growers out of business in the Rochester area of New York State by 1941.

Systemically invaded spearmint shoots exhibit a hyperplastic symptom-complex, described by the author as bull-shoots, the main axis of which is swollen, chiefly because of enlargement of the cells of the cortical tissues and the increased number of cells in the pith. The internodes of many of these shoots are several times as long as those of healthy ones, making the hypertrophied, chlorotic shoots abnormally tall and causing them to exhibit marked dark red or purplish coloration of the stem. The leaves are dwarfed, chlorotic, thickened, and brittle, many showing a rough, curling, savoying effect, and also sometimes anthocyanescence. The buds in the axils are usually proleptic, and developing into tiny bull-shoots, which in extreme cases cluster about the main stem. In healthy shoots these axillary buds remain undeveloped. Occasionally systemically invaded rhizomes may result from infection at the growing point, exhibiting the same swollen condition noted in the bull-shoots. Most bull-shoots arise, however, from infected buds on otherwise uninvaded rhizomes. Should this delicately adjusted relationship between the rust and the swollen shoot be disturbed by temperatures above 21° C. or by dry soil conditions, of which even healthy plants are not long tolerant, necrosis sets in. It is usually basifugal, but may occur at any place on the bull-shoot and progress both ways, and if it develops first at the base, the whole shoot may collapse and die. If, on the other hand, the upper parts of the bull-shoot die first, the proleptic, axillary buds below the necrosis become particularly large and long. Necrosis of the rhizome begins where the bull-shoots on it have reached their maximum development, and have themselves begun to die.

The first evidence of localized uredo and teleutosori following aecidiospore or uredospore inoculation of the leaves is the appearance of small, yellowish flecks on one or both surfaces of the leaf, enlarging until some are 2 mm. in diameter. At first chloranemic, they finally become necrotic, brown spots which, if the sori are abundant, may become confluent and cause necrosis of larger areas of the leaf. Premature defoliation, which in field-grown mint is responsible for the most severe losses, follows even moderate infection.

The fungus was found not to overwinter as mycelium in the rhizomes, thereby confirming Vergovsky's claim [*R.A.M.*, xv, p. 527] for field-grown peppermint.

Uredospores adhering to the rhizomes or tissue in sori on leaves left on the rhizomes constitute the primary inoculum in the greenhouse. Teleutospores may also be present but do not germinate readily and are relatively unimportant as primary inoculum [ibid., ii, p. 179]. Several cycles may be initiated by the uredospores, but in November or December, after the first cutting, new growth provides excellent infection courts for the basidiospores derived from teleutospores on leaves or the stubble. Later cycles may be initiated by aecidiospores. Control by the hot-water method of Ogilvie and Brian [ibid., xv, p. 763; xvii, p. 6] was probably effective because it killed the spores on the rhizomes and not the mycelium. Treatment of rhizomes by washing only resulted in 27·2 per cent. bull-shoots, by hot water (10 minutes at 44°) followed by dipping in wash water from the preceding treatment in 5·3 per cent., by hot water only in none, while the control gave 39·4 per cent. The use of fungicides might reduce losses in the established bed but is undesirable as the mints are used in food. By planting rhizomes 2 to 4 in. below ground, one grower reduced the ravages of the rust; apparently the inoculum fails to reach the parts above ground. While the development of a rust-immune spearmint may be feasible for the field crop, it is hardly likely to be worth while in the greenhouse.

Campos (A. R.). **Moléstias da Mamoneira no Estado de Pernambuco.** [Castor diseases in the State of Pernambuco.]—*Bol. Agric., Pernambuco*, ix, 1, pp. 55–59, 4 pl., 1942. [Received February, 1946.]

The two fungi responsible for castor [*Ricinus communis*] diseases in Pernambuco, Brazil, were experimentally determined as *Fusarium orthoceras* App. & Wr. [cf. *R.A.M.*, xx, p. 235] var. *ricini* Arruda, which also attacks the same host in São Paulo, and *Sclerotinia ricini* [ibid., vi, p. 526]. The cultivation of the black S(anta) R(osa) variety is advocated as a control measure against *F. orthoceras* var. *ricini*.

Campos (A. R.). **Moléstias da Cana de Açúcar em Pernambuco.** [Sugar-Cane diseases in Pernambuco.]—*Bol. Agric., Pernambuco*, viii, 2, pp. 169–174, 4 pl., 1941. [Received February, 1946.]

None of the fungi isolated from sugar-canes suffering from root rot in Pernambuco, Brazil, caused any symptoms of infection in inoculation experiments, and the disease is therefore provisionally attributed to adverse soil conditions. Other pathogens attacking the crop in the State are *Leptosphaeria sacchari*, *Thielaviopsis* [*Ceratostomella*] *paradoxa*, *Fumago sacchari*, *Colletotrichum falcatum* [*Physalospora tucumanensis*], and *Melanconium* (*Trichosphaeria*) [*Pleocyta*] *sacchari*.

Mal da raiz da Cana de Açúcar. [Sugar-Cane root rot.]—*Bol. Agric., Pernambuco*, ix, 2, pp. 115–116, 1942. [Received February, 1946.]

The following measures are recommended by the Agronomic Research Institute, Recife, Pernambuco, Brazil, for the control of sugar-cane root rot of obscure origin [see preceding abstract]: improved methods of soil drainage, rolling, harrowing, furrowing, and the like; application of stable and other organic manures and wood ash; use of selected material for 'seed'; cultivation of resistant varieties, notably P.O.J. 2878, and submission of specimens of suspected material to the Research Institute for accurate diagnosis.

Wiehe (P. O.). **Red rot and M 134/32.**—*Rev. agric. Maurice*, xxiii, 6, pp. 242–243, 1 fig., 1944.

The increasingly serious incidence of red rot of sugar-cane [*Physalospora tucumanensis*] in 1944 affecting notably the variety M 134/32, which is of particular importance for sugar cultivation in Mauritius, led the author to resume his studies of this widespread disease.

Initial red-rot infection may occur (*a*) at or near ground-level, usually after mechanical injury, a rare type; (*b*) following borer injuries, the lesions usually being restricted to a small marginal area round the galleries; (*c*) at the growth ring, one-third to half-way up the stem, observed on bent canes, infection coinciding with the outer bend of the growth ring, and frequently associated with desiccation of the epidermis of the rind, whether healthy or diseased. Such desiccation is thought to be due primarily to the April cyclone. Primary infection became manifest at the exterior of the bend, where growth ring tissues were dried up; this was seen both in virgin and ratoon canes.

The author concludes that M 134/32, while still exhibiting higher resistance to *P. tucumanensis* than most of its predecessors, such as the highly susceptible and now discarded DK/74, should not be grown as a 'grande-saison' cane, and that advanced 'babas' should not be left, as these shoots are much more liable to attack by the pathogen.

Baldacci (E.). **Contributo alla sistematica degli Attinomiceti: x–xvi.** [A contribution to the systematics of the Actinomycetes: x–xvi.]—*Atti Ist. bot. Pavia*, Ser. 5, iii (3), pp. 139–193, 2 pl., 1944. [Received February, 1946.]

In these further papers the author continues his studies on the systematic position of Actinomycetes [*R.A.M.*, xix, p. 436; xxv, p. 185], the fungi dealt with including *Actinomyces madurae*, *Proactinomyces ruber*, *P. pseudomadurae*, *P. polychromogenus*, *A. violaceus*, and *A. caeruleus*. Some 200 Latin binomials of species, varieties, and synonyms of species studied by the author are listed.

Viégas (A. P.). **Alguns fungos do Brasil. V. Basidiomycetos-Auriculariales.** [Some fungi of Brazil. V. Basidiomycetes-Auriculariales.]—*Bragantia, S. Paulo*, v, 3, pp. 197–212, 4 pl., 2 figs., 1945.

This further instalment of the author's critically annotated list of Brazilian fungi [*R.A.M.*, xxiv, p. 474] includes, *inter alia*, *Helicobasidium compactum* [ibid., xix, p. 369] on *Inga* sp., *Hybanthus atropurpureus*, and *Urtica* sp., *Septobasidium castaneum* [ibid., xv, p. 59] associated with an undetermined insect on the Olandy cassava variety and with *Aspidiotus symbioticus* on *Ficus* sp., *S. fuscum* with coccids on lime and orange, *S. lepidosaphis* with coccids on orange, *S. pseudopedicellatum* [ibid., xx, p. 13] with unspecified insects on orange and lime, with coccids on citron, orange, and *Aleurites fordii*, and on pigeon pea (*Cajanus indicus*) [*C. cajan*; no insect symbiont mentioned], and *S. saccardinum* with a coccid on pear, and with unidentified insects or coccids on mulberry [ibid., xix, p. 91], *A. fordii*, and numerous other hosts.

Di Fonzo (M. A.). **Las Uredineas del Chaco.** [The Uredineae of the Chaco.]—*Publ. misc. Minist. Agric., B. Aires*, Ser. A, ii, 12, 12 pp., 1946.

Included in this annotated list of rusts of the Chaco, Argentina, is *Puccinia psidii* [*R.A.M.*, xxv, p. 141], the agent of severe damage to guava (*Psidium guajava*). It occurs under local conditions exclusively in the uredospore stage.

Lindquist (J. C.). **Las especies de Puccinias parásitos de Malváceas en la República Argentina.** [The species of *Puccinia* parasitic on Malvaceae in the Argentine Republic.]—*Not. Mus. La Plata*, Bot., x, 47, pp. 17–33, 7 figs., 1945.

Revised descriptions and critical notes are given on seven species of *Puccinia* occurring in Argentina on Malvaceae, including *P. schedonnardi*, hitherto found exclusively in the uredo and teleuto stages on *Muehlenbergia asperifolia* [*R.A.M.*, xviii, p. 392], and *P. malvacearum*. A key to their determination is provided.

WHETZEL (H. H.). **A synopsis of the genera and species of the Sclerotiniaceae, a family of stromatic inoperculate Discomycetes.**—*Mycologia*, xxxvii, 6, pp. 648–714, 36 figs., 1945.

The author places fifteen genera in the family Sclerotiniaceae as he conceives it, the type genus being *Sclerotinia* with the proposed type species *S. sclerotiorum*, and including also *S. trifoliorum* and *S. minor* (*S. candolleana* is placed in his new genus *Ciborinia*). *Monilinia* Honey is used for *M. fructicola*, *M. fructigena*, *M. laxa*, and others with a *Monilia* conidial state. *Stromatinia* Boud. includes as new combinations *S. cepivorum* (Berk.) Whetzel, with apothecia unknown, and *S. gladioli* (Drayton) Whetzel. The new genus *Botryotinia* is based on *B. convoluta* (Drayton) Whetzel, n. comb. (syn. *Sclerotinia convoluta* Drayton) and includes also *B. fuckeliana* (de Bary) Whetzel n. comb. (syn. *S. fuckeliana* (de Bary) Fuckel) and *B. ricini* (Godfrey) Whetzel n. comb. (syn. *S. ricini* Godfrey), with *Botrytis* of the *cinerea* type as conidial state. *Ovulinia* Weiss [*R.A.M.*, xix, p. 412] is accepted for *O. azaleae*. The recent species *S. polyblastis* Greg. and *S. narcissicola* Greg. are not included. The paper concludes with a host index of the genera of plants bearing Sclerotiniaceae.

WHETZEL (H. H.). **The Cypericolous and Juncicolous species of Sclerotinia.**—*Farlowia*, ii, 3, pp. 385–437, 10 pl., 4 figs., 1946.

Descriptions and figures are presented of 10 species of *Sclerotinia* which attack sedges and rushes, including two new ones.

ROBERTS (CATHERINE). **A comparative study of Torulopsis pulcherrima and Taphrina deformans in culture.**—*Farlowia*, ii, 3, pp. 345–383, 3 pl., 2 figs., 1946.

The apparent interrelationship of *Torulopsis pulcherrima* and *Taphrina deformans* was disclosed by the author's studies undertaken to test the validity of Windisch's proposal to incorporate *Torulopsis pulcherrima* in the order Taphrinales as *Candida pulcherrima* [*R.A.M.*, xx, p. 382].

Tabulated data show *T. pulcherrima* and *Taphrina deformans* to be similar in behaviour. Both fungi presented a similar yeast-like appearance when grown at room temperature; both produced reddish or pinkish non-carotinoid pigment, diffusible in the case of *Torulopsis pulcherrima* and non-diffusible in that of *Taphrina deformans*. In *Torulopsis pulcherrima* a predictable mutation-like change involving the production of white sectors occurred with great regularity in pigmented colonies, whereas *Taphrina deformans* showed unpredictable sectoring involving a colour change from pink to yellow or white, occurring frequently or sporadically. In culture both organisms were composed of single, ovoid to globose, budding cells, and in older cultures cell structures indicative of sporulation were observed, and interpreted as ascogenous cells, asci, and ascospores.

A tendency to differentiation of the red and white cultural types on the basis of cell morphology was observed in *Torulopsis pulcherrima* and found to be correlated with the sporulation phenomenon. No such morphological differentiation was noted in *Taphrina deformans* among the three cultural types. A constant uninucleate condition was found in the young vegetative cells of both fungi. *Torulopsis pulcherrima* fermented glucose, but *Taphrina deformans* did not. No physiological differences were observed to occur among the various cultural types of the two fungi.

The result of the author's researches are considered to support the more specific and recent proposal of Windisch [ibid., xx, p. 382] for the transference of *Torulopsis pulcherrima* to the Taphrinales, but, in view of the still imperfect state of knowledge of its cytology, sexuality, and variation the similarities recognized at present do not appear sufficient yet to justify Windisch's proposed transfer of *T. pulcherrima* to the genus *Candida*, and for its incorporation in the Taphrinales in a new family,

the Candidaceae. The finding of pseudomycelium and true mycelium in *T. pulcherrima* indicates that it does not belong to the Torulopsoideae as defined by Lodder [ibid., xiv, p. 192].

HAMMARLUND (C.). **Beiträge zur Revision einiger imperfekten Mehltau-Arten. Erysiphe polyphaga nov. sp. (Vorläufige Mitteilung).** [Contributions to the revision of some imperfect mildew species. *Erysiphe polyphaga* nov. sp. (Preliminary note).]—*Bot. Notiser*, *1945*, 1, pp. 101–108, 1945.

It has been shown by the writer [*R.A.M.*, iv, p. 431] and a number of other workers that many of the Erysiphaceae are narrowly specialized as to their host range, and the general tendency of present-day mycologists is to question the authenticity of a number of records in the relevant (especially early) literature concerning the transmission, by artificial inoculation, of certain mildews to plants of unrelated species. However, some recent sudden outbreaks of mildew in various nursery gardens near Stockholm pointed to the possible existence of highly polyphagous species among the Erysiphaceae. For instance, *Oidium begoniae* [ibid., xix, p. 222] is believed to have been first recorded in Sweden in 1932. In 1934 an *Oidium* developed on *Veronica speciosa*, and in the following year perithecia were found in profusion. In 1935 *O. calanchoeae* Lüst. was observed on *Kalanchoë blossfeldiana* [ibid., xiv, p. 586]. *O. cyclaminis*, which in 1933 infected a few flowers of *Cyclamen persicum* [ibid., xix, p. 153], in the following year destroyed the blossoms of the entire 3,000 plants in the same greenhouse. In 1939 about 100 Gloire de Lorraine *Begonia* seedlings from a mildew-free source were placed in a chrysanthemum house for propagation, and in a few weeks all had contracted severe infection from *O. chrysanthemi* [ibid., xix, p. 133]. In 1940 six boxes of *K. blossfeldiana* seedlings were kept for a few days under a table with fairly heavily mildewed *Begonia* plants before transference to a greenhouse already containing *Kalanchoë*; three weeks later some 10 per cent. of the recently potted additions had become infected, and the disease spread rapidly.

A study of the biological connexion between *O. calanchoeae* and *O. begoniae* was initiated on 29th April, 1943, by the inoculation of some *K. blossfeldiana* plants with conidia from Gloire de Lorraine *Begonia*. By 5th May conidial chains had been found on the inoculated plants, and the confirmatory results of repeated experiments during the same month convinced the writer of the identity of the two species. The subsequent inoculation of 100 different species of plants induced positive reactions in 62, belonging to 11 families, including, besides a number of *K.* spp., 18 species of *Sedum*, six of *Bryophyllum*, houseleek (*Sempervivum tectorum*), and other Crassulaceae, *Begonia*, *V. speciosa*, *Cyclamen persicum*, tomato, tobacco, potato, melon, cucumber, flax, *Chrysanthemum indicum*, *C. morifolium*, *Dahlia variabilis*, *Verbena hybrida*, *Hyssopus officinalis*, and *Ricinus communis*.

The shape and size of the conidia of the several biotypes used in these experiments varied greatly according to their hosts, and the term 'forma matricalis' is used to express such modifications. The collective name *Erysiphe polyphaga* is applied to the species hitherto differentiated as *O. calanchoeae*, *O. begoniae*, *O. cyclaminis*, *O. lycopersici* [ibid., x, p. 11], *O. tabaci* [*E. cichoracearum*: ibid., viii, pp. 341, 409], *O. solani* auct. (*E. solani* Vanha) [ibid., i, p. 361], *E. cichoracearum* (from melon, cucumber, and *D. variabilis*), *O. lini* [ibid., xiii, p. 515], *O. chrysanthemi*, *O. verbenae*, *O. hyssopi*, and *O. ricini*. *E. polyphaga* f.m. *veronicae-speciosae* refers exclusively to the strain of the fungus on *Veronica speciosa*. The conidia of *E. polyphaga* f.m. *chrysanthemi-indici* measure on an average 40 by 20 μ and those of f.m. *solani-tuberosi* 27 by 15 μ. If differences of such magnitude are to be found among the various formae matricales of the same biotype, the size of these organs is obviously no fit criterion for the erection of a new species of *Oidium* unless corroborated on the biological side by the results of exhaustive inoculation experiments.

Host modifications are also of great importance in connexion with perithecial production. Inoculation experiments have so far resulted in perithecial formation only in the case of *E. polyphaga* f.m. *veronicae-speciosae*, but some years ago six small perithecia were detected on a naturally diseased *Begonia* plant. These organs were also observed by the author twice in Sweden on cucumber and on *D. variabilis* in Ecuador, while references in the literature to the development of perithecia on potato and tobacco also probably relate to the same fungus.

A close relationship appears to exist between *E. polyphaga* and *E. cichoracearum*, the sole morphological difference being the occasional occurrence in the former (f.m. *veronicae-speciosae*) of asci containing three or four spores besides the usual two-spored. Nevertheless, the separation of the two species appears justifiable on biological grounds, and a provisional diagnosis of *E. polyphaga* n.sp. is given [in German only]. It is characterized by a dense mycelium with simple conidiophores in close juxtaposition and long chains of ellipsoid, barrel-shaped or cylindrical conidia, furnished with a basal, dark brown appendage, mostly longer than the conidial diameter, and 8 to 12 or 10 to 20 asci (f.m. *veronicae-speciosae* and *begoniae*-Gloire de Lorraine, respectively), containing 2 to 4 ascospores.

Quite apart from its theoretical interest, the discovery of this polyphagous mildew on a number of important agricultural and horticultural plants is of considerable practical importance.

ANDERSON (P. J.). **Diseases of Tobacco in 1943.**—*Bull. Conn. agric. Exp. Sta.* 478, pp. 105–110, 1944. [Received January, 1946.]

In this report [cf. *R.A.M.*, xxiii, p. 45] it is stated that tobacco wildfire [*Pseudomonas tabacum*: ibid., xxiii, p. 430; xxiv, p. 404], though it had almost disappeared locally some years before, was widespread on a broadleaf farm in Glastonbury, Connecticut, in 1943, but was not observed elsewhere. Frenching [ibid., xix, p. 499], distinguished by narrow strap-shaped leaves, is somewhat uncommon in Connecticut; it was found in one grower's seed-bed, but the plants, when set in the field, quickly recovered. It appears that the condition must have been due to some soil abnormality. The prevalence of mosaic on one farm in East Windsor appeared to have originated from unsterilized ground tobacco stems used in the fertilizer mixture.

Further spraying tests again demonstrated that under greenhouse conditions and in the seed-beds fermate (2 lb. per 100 gals.), applied twice a week from the time the seedlings had developed about four leaves, gave perfect control of mildew [*Peronospora tabacina*: ibid., xxiii, p. 45]. Fermate-treated plants were not affected by damping-off. In the seed-bed tests, one section was treated by paradichlorobenzene fumigation, the crystals being distributed every second night on cloth frames over the plants. This gave complete control as long as the treatment was continued. When fumigation ceased, after the plants were ready for setting, mildew developed in about ten days.

Fusarium wilt (*F. oxysporum* var. *nicotianae*) [ibid., xxii, p. 456; xxiii, p. 460] appeared on a few plants at the Experiment Station farm, this being the first record of the disease in the State.

JOHNSON (J.). **Infection experiments with detached water-congested leaves.**—*Phytopathology*, xxxv, 12, pp. 1017–1025, 3 figs., 1945.

The mechanism of infection in detached, wounded, and uninjured, artificially water-congested leaves of Havana-Seed tobacco and other plants was investigated at the Wisconsin Agricultural Experiment Station in refrigerator pans used as moist chambers, the inoculum in most cases consisting of the wildfire organism, *Phytomonas tabaci* [*Pseudomonas tabacum*: *R.A.M.*, xxv, p. 142], while other tests were carried out with *Phytomonas* [*Pseudomonas*] *angulata, Cercospora nicotianae,*

Thielaviopsis basicola, *Pythium* sp., *Rhizoctonia* sp., two fungi not parasitic on tobacco, viz., *Septoria lycopersici* and *Helminthosporium sativum*, some common saprophytes, e.g., *Aspergillus niger* and *Penicillium* spp., a toxin from *Pseudomonas tabacum*, the tobacco mosaic virus (on the hybrid *Nicotiana tabacum* × *N. glutinosa*), rose Bengal dye, and India ink.

No penetration occurred through the normal (uncongested) unwounded tissues of the controls, except in a few cases of protracted incubation, e.g., with *C. nicotianae*. Stomatal entry was frequently effected through unwounded congested tissues. In the presence of congestive and leaf-surface water, particles of sufficiently minute dimensions pass through the apertures. The mechanism involved is the establishment of a capillary force through the formation of a channel of water for the transport of solutions or suspensions between the congestive water and that of the leaf surface. In wounded tissues penetration is usually immediate, and when the leaf is also water-congested, bacterial parasites in particular may be conveyed for considerable distances into the adjacent intercellular areas, where they find enough moisture and nutrients to promote their multiplication and consequent pathogenicity. The destruction of natural barriers to infection by wounding may further impair individual constitutional variations in resistance to disease.

Costa (A. S.). **The relationship between American Tobacco streak and Brazilian 'necrose branca' or 'couve'.**—*Phytopathology*, xxxv, 12, pp .1029–1030, 1 fig., 1945.

In addition to the resemblances already observed between the symptoms induced in tobacco by the streak virus and that of the white necrosis ('necrose branca') or 'cabbage-leaved tobacco' ('couve') occurring in São Paulo, Brazil [*R.A.M.*, xxiv, p. 477], a further similarity has been detected. In the course of studies at the Rockefeller Institute for Medical Research, Princetown, New Jersey, in 1943, the writer noticed that the flowers of Turkish tobacco plants suffering from streak presented a typical feature of the Brazilian disease not hitherto recorded in connexion with the former virus, namely, the termination of the petals in a filamentous appendage.

Grosjean (J.). **Het parasitaire karakter van eenige Polyporaceeën.** [The parasitic character of some Polyporaceae.]—Thesis, Univ. Amsterdam, 96 pp., 5 figs., 1942. [English summary. Received November, 1945.]

Polyporaceae are generally assumed to cause wood rot only in old trunks of living trees, but the writer successfully infected three- to five-year-old oak (*Quercus pedunculata*), poplar (*Populus alba*), and alder (*Alnus incana*) branches with an isolate of *Fomes igniarius* from *Amelanchier vulgaris* (Ottawa, Canada); of *Alnus glutinosa* with an isolate of the same fungus from birch (*Betula verrucosa*) from Omsk, Siberia; of *Pseudotsuga douglasii* [*P. taxifolia*] with a culture of *F. laricis* from the Forest Products Laboratory, Madison, Wisconsin; and of wild cherry (*Prunus avium*) with one of *F. pomaceus* supplied by K. St. G. Cartwright from England. Positive results were secured only by the introduction of the inoculum into the oldest annual rings of the branches. The fungi were more 'aggressive' when cultured on wood than when bread was used as a medium.

Trees are commonly supposed to be more susceptible to wood-rotting fungi during the winter than at any other season, but no evidence was forthcoming in these experiments of better results with early March inoculations than with those undertaken in April and May. The decay induced by the inoculations spread at the rate of only a few cm. a year.

The growth of saprophytic bark fungi on material for use in laboratory experiments may be prevented by treatment with acetic acid, which must be kept from contact with the wood, or by one hour's sterilization in an autoclave at 0·75

atmospheric pressure and a temperature of 115° C.; ammonia, formalin, and mercuric chloride are unsuitable for the purpose. Desiccation of the branches may be obviated by maintenance in a saturated atmosphere, but not actually in water. Under these conditions the type of decay induced, e.g., by *F. igniarius* on poplars (*Populus nigra* and *P. alba*), *F. robustus*, *F. laricis*, *F. pomaceus*, *Daedalea unicolor*, and *Polyporus cuticularis* on *Populus alba*, *F. laricis* and *D. unicolor* on beech, *F. robustus* and *D. unicolor* on oak, and the latter on *P. nigra*, was similar to that observed in nature, but proceeded at a more rapid rate and was less specialized.

A suitable technique for the staining of mycelium in wood consists in heating the material in picro-aniline blue, as described by Cartwright (*Ann. Bot., Lond.*, xliii, pp. 412–413, 1929), followed by successive washing in water, alcohol, and lactophenol-alcohol.

CARTER (J. C.). **Wetwood of Elms.**—*Bull. Ill. nat. Hist. Surv.*, xxiii, 4, pp. 407–448, 25 figs., 4 graphs, 1 map, 1945.

A full account is given of studies and field observations carried out in Illinois from 1939 to 1943 on an unusual elm wilt first noticed at Hinsdale in the summer of the former year and subsequently shown to be a secondary pathological manifestation of wetwood, a water-soaked, dark discoloration of the heartwood closely related to slime flux, a chronic bleeding at crotches and wounds, and associated with an abnormally high sap pressure in the trunk. None of the 284 trees affected at Hinsdale died during the period under review, and only 73 wilted in more than one of the five years. The elm species suffering from the disease were the American (*Ulmus americana*) and its cultivated varieties Moline and Littleford, the slippery (*U. fulva*), the English (*U. procera*), and the Siberian (*U. pumila*). Cultures of 239 out of 346 samples from 21 counties yielded a bacterium which is named *E. nimipressuralis* n.sp., similar to, but not identical with, *Erwinia salicis* [*R.A.M.*, xiii, p. 334] and *Pseudomonas lignicola* [ibid., ix, p. 5].

The organism inhabits principally the vessels and ray cells of the trunk. It does not grow in sufficient abundance to cause general clogging of the conducting tissues, nor does it induce disintegration of the tissues occupied. Wetwood and flux developed as a sequel to trunk wood inoculations with the bacterium, while the introduction of wetwood sap into the current-season wood of young trees caused wilting. The greyish-brown streaks in the current-season wood appear to be due to the discoloured sap and not to the bacterium itself, which was seldom isolated from wilting branches.

Trunk pressures in wetwood-affected elms commonly reached 5 to 30 lb. per sq. in. and attained a maximum in trees that did not flux, a pressure of 60 lb. per sq. in. being recorded in one tree in 1942. Pressures in diseased trees began to develop in April and early May, increased until August or September, and then fell until late December or January. In inoculated greenhouse trees they followed a diurnal cycle with a maximum between 11 a.m. and 1 p.m. and a minimum between 7 and 11 p.m.

Gas from infected trees contained 46·4 per cent. methane, 33·8 per cent. nitrogen, 14·3 per cent. carbon dioxide, 4·5 per cent. oxygen, and 1 per cent. hydrogen. Phosphates and a large quantity of potassium were present in sap samples. P_H determinations showed the sap and discoloured wood of diseased trees to be alkaline (7·67 and 7·39, respectively), in contrast to the normal acid reactions (6·35 and 5·89, respectively).

E. nimipressuralis is a rod with rounded ends, 0·68 to 2 by 0·34 to 0·68 (average 0·68 to 1·35 by 0·34 to 0·68) μ, occurring singly, or rarely in pairs or chains; motile by means of up to six peritrichiate flagella; anaerobic, Gram-negative, and non-acid-fast. On potato dextrose agar the colonies are circular, smooth, flat or slightly

raised, and whitish-cream. Gelatine is not liquefied; nitrates are reduced to nitrites without gas formation; hydrogen sulphide is produced, but no indole; starch is not hydrolysed or pectin fermented; milk is coagulated; litmus and bromocresol purple are reduced; the methyl red and Voges-Proskauer tests are positive. The minimum, optimum, and maximum growth temperatures are 5° C. or below, 24° to 30°, and 37°; the thermal death point 45° to 55°; and the minimum, optimum, and maximum P_H 4·67, 6·82 to 7·5, and 10+, respectively. The bacterium evolves both acid and gas from arabinose, rhamnose, xylose, dextrose, fructose, gelactose, manumose, lactose, maltose, trehalose, melibiose, cellobiose, mannitol, sorbitol, and salicin, and a slight amount of both from starch, the data in connexion with sucrose, raffinose, melezitose, dulcitol, glycerol, and elm sawdust were conflicting.

The only one of the various measures tested to give at least temporary control of flux was the installation of drains in the trunks to provide an artificial outlet for the abnormally produced sap and gas.

Ankudinov (A. M.). Сердцевинная гниль осины и меры борьбы с ней. [Heart rot of Aspen and its control.]—*Труд. Всесоюз. Научноисследов. Инст. Лес. Хоз. ВНКЛХ.* [*Trans. U.S.S.R. Inst. For. Res.*], vii, pp. 3–67, 1939. [Abs. in *For. Abstr.*, vii, 2, p. 221, 1945.]

This is an expanded account of studies on heart rot of aspen (*Populus tremula*), a widely distributed forest tree in the U.S.S.R., caused by *Fomes igniarius*, already noticed from another source [*R.A.M.*, xix, p. 373].

Ermilova (Mme. V. S.). Причины и развития гнили у осины и меры борьбы с ней. [Causes and control of rot in Aspen trees.]—*Труд. Всесоюз. Научноисследов. Инст. Лес. Хоз. ВНКЛХ.* [*Trans. U.S.S.R. Inst. For.Res.*], vii, pp. 69–77, 1939. [Abs. in *For. Abstr.*, vii, 2, p. 221, 1945.]

Studies of stands of 35 to 40-year-old aspen trees in the forests of the Tartar A.S.S.P. and on 1,000 trees, 5 to 12 years old, in the Kama river basin, some growing on flood land and others on terraces above flood-level, showed that aspens both of vegetative and seedling origin develop two types of rot, stump and stem rot. The latter develops twice as quickly as the former and results mainly from unhealed wounds left by dead branches, which are attacked by *Fomes igniarius* [see preceding abstract]. Proper thinning and artificial pruning to supplement self pruning are discussed.

Service and regulatory announcements, July–September, 1945. Plant quarantine import restrictions, Commonwealth of Australia.—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 164, p. 41, 1945.

Proclamation No. 20 P, gazetted 20th January, 1941, amending Proclamation No. 2 P (19th September, 1935), prohibits the importation into Australia, except by permission of the Minister of Agriculture, of all plants or parts thereof (excluding the seeds) of the sub-orders or tribes Pomeae or Pruneae, of the order Rosaceae, which were grown in any country harbouring pear- or fireblight (*Bacillus amylovorus*) [*Erwinia amylovora*: *R.A.M.*, xv, p. 382].

New Citrus canker regulations.—*N.Z. J. Agric.*, lxxii, 1, p. 80, 1946.

The Citrus Canker Regulations, 1945, which became effective on 6th December 1945, superseding those of 1940, limit the powers of an inspector to order the destruction of all citrus trees found infected with citrus canker [*Xanthomonas citri*] and also of trees located within 36 ft., measured from trunk to trunk, of such trees. On recurrence of citrus canker in a plantation within 12 months, inspectors may require all trees remaining on the land, or such as he may specify, to be destroyed.

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HENRY (L. K.). **Ecological notes on fungi.**—*Proc. Pa Acad. Sci.*, xix, pp. 140–142, 1945.

Notes are given on the ecology of fungi found growing on burned-over soil supporting a mixed oak type of vegetation on a section of the State Game Lands, Pennsylvania, and on mixed oak slash piles from the previous year's thinning. The author concludes that the Myxomycetes are concerned in the initiation of slash decay and subsequently disappear, and that the annual leathery Polyporaceae are the principal agents of disorganization, followed by the perennial and woody species, *Stereum* spp., and Ascomycetes.

RENNERFELT (E.). **Inverkan av Tallkärnvedens fenolsubstanser på några blåytesvampars tillväxt jämte ett försök till kvantitativ mättning av blånadens intensitet.** [The influence of the phenol substances of Pine heartwood on the growth of some blueing fungi together with an experiment on the quantitative determination of the intensity of blueing.]—*Medd. Skogsförsöksanst., Stockh.*, xxxiv, pp. 391–416, 1 diag., 3 graphs, 1946. [English summary.]

The phenolic substances in Scots pine (*Pinus sylvestris*) heartwood, pinosylvin and pinosylvin monomethylether [*R.A.M.*, xxiii, p. 506], were shown to exert a considerable degree of inhibition on various agents of blueing [ibid., xxiv, p. 348] in malt agar cultures at 22° C. For instance, taking 100 as the standard figure for growth in 1 per cent. ethyl alcohol, the addition to the test tubes of 0·02 per cent. pinosylvin entirely inhibited the development of *Phialophora fastigiata, Phoma lignicola*, and *Pullularia pullulans*, while the relative figures for *Cladosporium herbarum* and *Stemphylium graminis* were 3 each. Pinosylvin monomethylether acted similarly but less powerfully, none of the fungi being entirely suppressed even at the maximum dosage of 0·02 per cent., at which the growth of the three most sensitive, *C. herbarum, Phoma lignicola*, and *S. graminis* was represented by 8, 10, and 5, respectively. *Phialophora fastigiata* was highly resistant to pinosylvin monomethylether, and *Ophiostoma* sp. to both substances.

Further experiments were made on sterilized pine sapwood blocks, impregnated with the phenolic substances, which were inoculated with spore suspensions of the blueing organisms (1,000,000 spores per ml.) by a 10-second dip and placed in Petri dishes kept moist with filter paper, another series of untreated blocks being similarly inoculated for control purposes. The intensity of infection was estimated by comparison with standard briquettes made of mixtures in different proportions of wood flour and a combination of 1 part of animal charcoal to 2 parts fresh spruce needles, their colour ranging from the natural hue of the wood to almost black. The colour of briquettes was estimated electrically by the General Electric Reflection Meter or Brightness Tester (*Paper Tr. J.*, c, 26, 1935), the 'pigment' unit being an equivalent to the amount of pigment in a briquette made from a mixture of 10 gm. wood flour and 0·01 gm. charcoal and needles.

All the blueing fungi made good growth on natural sapwood, but their capacity for pigmentation varied considerably, being greatest in *S. graminis* (75) and least

in *O.* sp. (6), while *C. herbarum* and *P. fastigiata* were intermediate (33). On the treated blocks there was a substantial reduction of pigment production, e.g., in the case of *S. graminis*, to between 2·9 and 7·9 and 1·6 to 13 for those impregnated with pinosylvin and pinosylvin monomethylether, respectively.

In further tests the discoloration of natural sapwood was found to increase from the first week to the third, but in the blocks impregnated with 1·4 per cent. pinosylvin monomethylether the fungi made little headway until the third or fourth week; by this time *P. fastigiata*, in particular, had caused considerable blueing (7·6 pigment units at the end of the month).

Compared with the reflection-meter method, the visual estimation of discoloration by the three-grade scale of Lagerberg *et al.*: [*R.A.M.*, ix, p. 76] was found to be inaccurate and unreliable.

SCHEFFER (T. C.) & VAN KLEECK (A.). **The decay resistance of wood impregnated with fire retarding ammonium salts.**—*Proc. Amer. Wood Pres. Ass.*, xli, pp. 204–210, 1945.

Laboratory tests indicated that commercial absorptions (2, 4, and 6 lb. per cu. ft.) of mono- and diammonium phosphate and of ammonium sulphate, used for fire-proofing timber, conferred a high initial resistance to decay in pine sapwood, and even after considerable leaching had taken place decay resistance usually remained high and never fell below that of untreated wood. It is thought that treatment with these salts of timber to be used above ground may provide a substantial degree of protection against decay, but field tests are required to confirm these laboratory results. There was no evidence that the preservative values of borax, boric acid, and zinc chloride were impaired by combining with them the above-mentioned salts.

STARKER (T. J.). **Preservative treatment of fence posts: 1944 progress report on the Post Farm.**—*Bull. Ser. Ore. Engng Exp. Sta.* 9 F, 7 pp., 1 graph, 1945.

At the seventh annual examination of the Post Farm at the Oregon State College on 17th October, 1944 [*R.A.M.*, xxiv, p. 171], 29 posts were removed on account of failure, of which eight were in the untreated Douglas fir [*Pseudotsuga taxifolia*] series. The first failure in 16 years occurred among the 25 lodgepole pine [*Pinus contorta*] posts treated with a mixture of mercuric chloride, arsenic oxide, and sodium chloride. All the 25 western hemlock [*Tsuga heterophylla*] and 25 Douglas fir posts set in 1936 after treatment with Wolman salts [triolith] were still in position at the date of inspection, and so were 25 each of the Douglas firs set in 1928 after the introduction of mercuric chloride through one, two (in combination with arsenic oxide), or three holes, or treated with ACM treater dust.

SEVERIN (H. H. P.) & FRAZIER (N. W.). **California Aster yellows on vegetable and seed crops.**—*Hilgardia*, xvi, 12, pp. 573–596, 8 pl., 7 figs., 1945.

The host range of the California aster yellows virus [a strain of aster yellows virus] among economic plants naturally infected includes 11 vegetables and 12 seed crops belonging to 14 species in 12 genera in 6 families, some of which have been previously reported [*R.A.M.*, vi, p. 297; viii, p. 694; x, p. 734; xx, p. 130; xxii, p. 206, and next abstract]. The following hosts may be mentioned: spinach (overlapping host ranges of California and New York aster ranges), chicory, endive, black salsify (*Scorzonera hispanica*), lettuce, Romaine lettuce (*Lactuca sativa* var. *longifolia*), cabbage, cauliflower, sprouting broccoli, Chinese radish, onion, potato, Belgian carrots, parsley, turnip-rooted parsley (*Petroselinum hortense* var. *radicosum*), celery, celeriac, and parsnips. The virus overwinters in biennials, perennials, and overwintering leafhoppers. Symptoms induced by the virus on each species or variety naturally infected are described.

POUND (G. S.). **Effect of air temperature on the concentration of certain viruses in Cabbage.**—*J. agric. Res.*, lxxi, 11, pp. 471–485, 1 fig., 1945.

The results presented in this study interpret observations on the epidemiology of the cabbage mosaic disease as it occurs in the mid-western area of the United States. In the latitude of Wisconsin the symptoms of virus A [a strain of turnip mosaic virus: *R.A.M.*, xxiv, p. 439; xxv, p. 53] appear in early summer and only decline with the gradual lowering of the temperature in the late summer and autumn, when virus B [a strain of cauliflower mosaic virus] becomes predominant. Isolations of virus A from field plants late in the season yielded insignificant concentrations and often none at all, but virus B responded abundantly. A reduced rate of production of virus A and an increase in that of B is thought to account for these reactions. It is further remarked that in the southern belt of States, where cabbage is grown in winter and early spring, virus B is much more in evidence than A. In regard to the black-ring disease of cabbage [a strain of turnip mosaic virus], which Tompkins *et al.* [ibid., xvii, p. 151] state is essentially a winter disease and not often encountered in summer, temperature studies failed to provide any explanation for this; in one experiment the present author found that the effect of temperature on black-ring virus concentration was similar to that on virus A, but earlier work had shown the black-ring virus to cause more virulent necrosis at low temperatures than virus A.

Quantitative studies showed that length of day had no measurable effect upon virus concentration, but the symptoms of A alone and A and B together were less severe, and those of B alone more so under short- than under long-day exposures. Special interest is attached to the fact that viruses A and B exhibit a parallel increase of symptoms with increase in virus concentration. Virus A and black-ring virus occurred in notably higher concentration in plants growing at 28° C. than in others grown at 16°, both when infecting cabbages alone or together with either cabbage virus B or cauliflower mosaic virus. The concentration of cabbage virus A in cabbage grown in a 15-hour day at either 28° or 16° was not significantly different from that in plants growing in an 8-hour day, whether the virus occurred alone or together with virus B in the host. Virus concentration in plants inoculated with A or A and B together, incubated at 22° and later removed to the greenhouse at temperatures of 16° and 28°, respectively, fell in the case of A in plants at 16° below that in those grown at 28°. Virus B shows the reverse tendency. The systemic accumulation of virus A in plants inoculated and held at 5° for 60 days was almost negligible, but when these plants were transferred to a temperature of 28°, the virus concentration after 30 days differed little from that in plants which had grown 90 days at the same temperature. Virus A concentration in plants infected with A or both viruses differed little. It is thought that the increased severity of symptoms in A and B viruses together over that of either virus alone arises from the cumulative effect of each virus on the host metabolism. As cooler temperatures prevail in autumn the concentration of virus A falls progressively.

Finally, the author points out that the effects of the temperature factor on virus concentration are sufficiently strong to justify due consideration of the temperature at which the host is grown when the physical properties of a given virus are being examined, because the original concentration of the virus extract may to a large extent determine the point at which inactivation is noted as a result of dilution, ageing, or exposure to given temperatures.

FELTON (M. W.) & WALKER (J. C.). **Environmental factors affecting downy mildew of Cabbage.**—*J. agric. Res.*, lxxii, 2, pp. 69–81, 4 figs., 1946.

Investigations at the Wisconsin Agricultural Experiment Station on the effect of environmental conditions upon the development of downy mildew (*Peronospora parasitica*) [*R.A.M.*, xxiv, p. 259; xxv, p. 196] on cabbage seedlings showed that the

optimum temperature for sporulation of the fungus is from 8° to 10° C., for conidial germination ranges from 8° to 12°, and penetration of the host occurs most rapidly at 16°. Thus, relatively low temperatures are required for the rapid reproduction of *P. parasitica* as a major pathogen of cabbage.

The optimum temperature range for the development of the haustoria was between 20° and 24° and the most rapid development of disease occurred at 24°. In the presence of high humidity, those lesions first noticed also sporulated first. At the same time, it was evident that the rapidity of infection was conditioned by the temperature most conducive to the spread of mycelium within the host. Temperatures of 24° and 28°, respectively, were the upper limits for sporulation and re-infection, and faster growth in the host at these temperatures led to more rapid maturation and falling of the lower leaves. Host and fungal growth was slower at 16°, but sporulation was most prolific and re-infection markedly more virulent. The lower optima for sporulation, germination, and penetration of the host are, therefore, more decisive for disease development than the higher optima for the growth of the fungus. The virulence of the disease at 10° to 15° may best be explained by the effect of temperatures on the production of inoculum, spore germination, and infection.

Studies of plants cultured in a range of controlled nutrients did not serve to elucidate the discrepant data recorded in the literature on the effect of fertilizers on *P. parasitica*, and control is not likely to be made more effective by endeavours to amend existing practice in fertilizing seed-beds.

Eradication of cruciferous weeds is considered valueless, having regard to the fact that collections of the fungus from widely separated localities in the United States all appeared to be representative of a single physiologic race, parasitic only on members of *Brassica oleracea*, which are not found growing in a wild state in that country.

RANGEL (J. F.). **Two Alternaria diseases of cruciferous plants.**—*Phytopathology*, xxxv, 12, pp. 1002–1007, 1 fig., 2 graphs, 1945.

Alternaria brassicae (Berk.) Sacc. [*A. oleracea* Milbrath], the agent of leaf and pod spot and general head-browning of cauliflower, broccoli, and other crucifer plants, and of damping-off, wire stem, and spotting of seedlings in the United States, is readily distinguishable by its morphological and cultural characters from *A. herculea* [*A. brassicae* (Berk.) Sacc.], another parasite of the same plant family causing a grey foliar spot [*R.A.M.*, xv, pp. 188, 467]. Both species are virulent pathogens, capable of attacking susceptible plants at any age and independently of injury, but a minimum wetting period of 18 hours is a pre-requisite condition for infection. Both fungi may be harboured by the seed in the form of spores or latent mycelium. The conidia of *A. oleracea* may retain their viability and pathogenicity for over six months. Seedlings grown in infested seed-beds may carry the inoculum to the field, where the organism is disseminated, mainly through the agency of water, from the dead lesions and decaying plant refuse. Cabbage seed treatment with semesan and arasan reduced the incidence of damping-off and wire-stem symptoms.

The cotyledons of seedlings from infected seeds bore sharply defined, circular, dark brown to black, sunken spots and damping-off may occur when very young seedlings are affected. When infection occurs after the seedling tissues have hardened, the seedlings survive but the stems are distorted and growth impaired, causing symptoms resembling wire stem due to *Rhizoctonia* [*Corticium*] *solani*. Pre-emergence damping-off may also occur.

HUIZINGA (T. S.). **'Bruin in de knol' bij Koolrapen.** ['Brown heart' of swedes.]—*Tijdschr. PlZiekt.*, xlvi, 4, pp. 141–145, 1940. [Received February, 1946.]

A tabulated account is given of experiments from 1937 to 1939 in the control of boron deficiency in swedes in the Aalst district of Holland [*R.A.M.*, xviii,

p. 153], where the crop is grown largely for human consumption. In the first year even the maximum dosage of 50 kg. borax (applied in the form of bibor, a product of the N.V. Landbouwbureau Wiersum, Groningen, containing 20 per cent. borax), failed to eliminate the trouble completely, whereas in the second 20 kg. sufficed to cure the condition.

WATSON (MARION A.). **The transmission of Beet mosaic and Beet yellows viruses by aphides: a comparative study of non-persistent and a persistent virus having host plants and vectors in common.**—*Proc. roy. Soc.*, Ser. B, cxxxiii, 2, pp. 200–219, 1 fig., 1946.

The author's researches show that the maximum capacity of the vectors (*Myzus persicae*, *Aphis fabae*, and *M. circumflexus*) for infecting beets with mosaic virus is when they have fed for only a few minutes on the infected plants after a period of fasting. After infection feeding, power to infect is rapidly lost by vectors feeding on healthy plants. However, as long as infective power remains a single vector can infect several plants. Infectivity is lost much more slowly when vectors fast after infection feeding.

In these functional characteristics, and also in its physical properties, this virus resembles virus Hy 3 [henbane mosaic virus], potato virus Y, cucumber virus 1 [cucumber mosaic virus], and other aphid-transmitted viruses, which have been called the non-persistent group.

Beet mosaic differs in some secondary characters from the other non-persistent viruses more than they differ from each other in being retained longer by the fasting vectors, and infectivity of the vectors may increase considerably with increasing infection feeding time, in the absence of preliminary fasting, though it rarely reaches the optimal level.

In beet yellows [*R.A.M.*, xxiii, p. 420; xxiv, p. 260] virus infectivity of the vectors is not affected by preliminary fasting, but always increases with increasing feeding time on both infected and healthy plants. Infectivity increases with increasing feeding time on the healthy plants whatever the infection feeding time, and consequently a delay always occurs before optimum infectivity is reached by the aphids after cessation of infection feeding. Loss of infectivity is more rapid in fasting than in feeding vectors.

The properties show that beet yellows belongs to the persistent group of viruses, although its persistence in fasting vectors is approximately the same as that of the non-persistent beet mosaic virus. The two types seem to be distinguished, not by the time for which they are retained by vectors, but by the effect of preliminary fasting.

As beet yellows and beet mosaic viruses have the same vector and host plant, the differences in their behaviour constitute properties peculiar to the viruses themselves, and are not induced by the conditions in which they are transmitted.

BENNETT (C. W.), CARSNER (E.), COONS (G. H.), & BRANDES (E. W.). **The Argentine curly top of Sugar Beet.**—*J. agric. Res.*, lxxii, 1, pp. 19–48, 8 figs., 1946.

These studies of the Argentine curly top disease of sugar beet, with special reference to its relationship to North American curly top and its potential capacity for injury if introduced into the sugar beet areas of the United States and other parts of the world, collate the results of investigations at Arlington, Virginia, on diseased plants from Argentina in 1927 and 1937 to 1939, and of work at the Tucumán Agricultural Experiment Station, Argentina, from September, 1940, to March, 1941.

North American curly top is distinguished from the Argentine variety by the following characteristics; the North American curly top vector (*Eutettix tenellus*) does not transmit the Argentine virus, which does not appear to infect tomato or

tobacco plants, although Giddings [*R.A.M.*, xvii, p. 786] has shown that some strains of the North American virus also do not do this; the Argentine virus causes more severe curling and distortion on seedlings of varieties resistant to North American curly top, but resistant and susceptible varieties throw off the Argentine infection in a marked degree. There has been no record of plants infected by the North American virus exhibiting this capacity for recovery, particularly in the case of susceptible varieties.

Striking similarities between the two diseases are shown in the almost complete identity of symptoms on all host plants on which they have been reported: all varieties of sugar beet bred for resistance to the North American virus have proved resistant to the Argentine type; the host range of both is the same, apart from some members of the Solanaceae; and at the present time their properties appear to be the same, or very similar.

Black's discovery [ibid., xxi, p. 36] of two strains of the potato dwarf virus, each transmitted by a different leafhopper, is thought to weaken the suggestions of those who are inclined to consider these viruses of the North and South American continents, respectively, as distinct and separate on the ground of the non-transmission of the South American pathogen by the North American vector. Superimposition of the North American on the Argentine virus is also considered to point to their being unrelated by virtue of the concept that complete infection of a plant by one virus confers immunity from attack by a cognate strain, but not by an unrelated virus. At the same time, Carsner's reinoculation of sugar beet plants attacked by an attenuated strain of the curly top virus had the result that infection became more complete [ibid., v, p. 339]; and Giddings [ibid., xvii, p. 786] showed that beet plants previously infected for at least a month by one strain of the virus were susceptible to attack by another in 15 combinations of 7 strains tested. The authors, therefore, are disposed to reject the evidence offered for the North and South American viruses being distinct and separate viruses.

On the various grounds cited above, the authors regard the North American curly top as caused by a single virus-complex—which they name *Ruga verrucosans* [ibid., xxiii, p. 85]; they consider the Argentine virus to be a variety, and name it *R. verrucosans* var. *distans*.

In the course of the experiments at Tucumán the behaviour of the Argentine vector, *Agalliana ensigera*, was studied and it was found in 1940–1 abundantly on mangelwurzels and sugar beets and less so on *Amaranthus* spp., *Portulaca* sp., *Datura stramonium*, *Zinnia elegans*, and *Chenopodium album*. Reproduction was effected readily on sugar beet and mangelwurzel, and *D. stramonium*, *D. meteloides*, *Z. elegans*, and to a lesser extent, *C. album* proved acceptable hosts for breeding. *Agalliana ensigera* failed to breed on tomato, Turkish tobacco, and *Nicotiana glutinosa*.

A. ensigera finds its nutrition in the phloem of sugar beet, leaving a partial sheath of salival secretion along the line of penetration. It recovers virus from phloem exudate liquids of infected beets, but differs from *E. tenellus* in not depositing salivary secretions in the liquids on which it feeds. The minimum incubation period of the virus in the insect, as observed, was 24 to 72 hours. A 36-day feeding period showed virus still present in viruliferous insects on a host plant immune from curly top.

Relatively high concentrations of the Argentine curly top virus appear to occur in the phloem of diseased sugar beets and mangelwurzels, the point of thermal inactivation lying between 75° and 80° C. Brief exposure to 50 per cent. alcohol did not inactivate the virus. Four of 20 actively growing sugar beet plants were successfully infected by needle. The virus was found to pass from the point of puncture by leafhopper inoculation at the distal end of a leaf downward to a distance of over 15 cm. in two hours. These properties are coincident with those observed in the behaviour of North American curly top virus.

Ken Knight (G.). **Pea diseases in Idaho.**—*Bull. Ida. agric. Exp. Sta.* 253, 13 pp., 7 figs., 1944. [Received February, 1946.]

The most destructive diseases of the Idaho pea crop are stated to be *Aphanomyces* root rot (*A. euteiches*), seedling damping-off, and stunting and stem-girdling of older plants (*Sclerotinia* spp.), and *Fusarium* wilt (*F. oxysporum* var. *pisi* f. 1). *A. euteiches* is likely to cause heavy damage only in years with a very wet spring; tri- or quadrennial crop rotation should be practised, avoiding the susceptible lucerne, sweet clover [*Melilotus*], and vetch. Against *S.* spp., deep ploughing-under of plant debris to prevent re-infection by the sclerotia, and crop rotation, e.g., with small grains, grasses, maize, potatoes, beets, or forage legumes, are recommended. There are many good wilt-resistant varieties and selections available.

Harter (L. L.), Zaumeyer (W. J.), & Wade (B. L.). **Pea diseases and their control.**—*Fmrs' Bull. U.S. Dep. Agric.* 1735, ii+28 pp., 15 figs., 2 maps, 1945.

In this bulletin, a revised edition of that issued in 1934 [*R.A.M.*, xiv, p. 279], notes are given in semi-popular terms on the symptoms, causes, and control of the chief diseases of peas in the United States.

Huyskes (J. A.). **Over de beteekenis van borium voor de Boonencultuur.** [On the significance of boron in Bean cultivation.]—*Tijdschr. PlZiekt.*, xlvi, 4, pp. 133–140, 1 pl., 1940. [Received February, 1946.]

From a study of the relevant literature and field observations in Holland the writer concludes that beans (*Phaseolus vulgaris*) are very unlikely to suffer from boron deficiency under ordinary cultural conditions. They are, however, very susceptible to an excess of the element [*R.A.M.*, xxi, p. 26], developing typical symptoms of foliar stunting, chlorosis, marginal necrotic spotting, upward curving of the lamina, and so forth, in 1939 in a plot to which borax was applied at a dosage of 20 kg. per ha.—the usual preventive treatment for heart rot of beet. Since beets are frequently succeeded by early potatoes and beans in the crop sequence, injury to the last-named from the cumulative effects of boron in the soil is by no means improbable.

Yu (T. F.). **The red-spot disease of Broad Beans (Vicia faba L.) caused by Botrytis fabae Sardiña in China.**—*Phytopathology*, xxxv, 12, pp. 945–954, 1945.

Red spot disease of broad beans, originally observed in Nanking by R. H. Porter in 1925, has been shown to be caused by *Botrytis fabae* Sardiña [*R.A.M.*, ix, p. 424; xvi, p. 724]. It is widely distributed in China, especially along the Yangtze river and near the coast, where the necessary high atmospheric moisture is provided for the two months prior to the bean harvest. Under environmental conditions suitable for the fungus, infected leaves may collapse or extensive defoliation preclude pod formation. The symptoms of the disease and the morphology and physiology of the pathogen are described. Of a large number of Leguminosae exposed to artificial infection by *B. fabae*, apart from broad beans, only vetch and garden and field peas reacted positively and showed slight infection, so that the host range of the fungus would appear to be very narrow.

The results of overwintering experiments suggest that perpetuation may be effected by the sclerotia, which survived the dormant period and germinated in the spring, although they have never been observed on diseased plants in the field. Conidia are formed in profusion on the foliage of early-infected plants and furnish abundant inoculum for the second outbreak, which commonly occurs in May, but they probably do not assist in the maintenance of the fungus through the winter.

Ken Knight (G.) & Blodgett (E. C.). **A survey of the diseases of the Carrot seed crop in Idaho with control recommendations.**—*Bull. Ida. agric. Exp. Sta.* 262, 23 pp., 18 figs., 1945.

The major diseases of carrots in Idaho were shown by surveys in 1943 and 1944 to be bacterial blight (*Xanthomonas carotae*) [*R.A.M.*, xxiii, p. 423], aster yellows [ibid., xxiii, p. 420], and storage rots (*Alternaria radicina, Sclerotinia sclerotiorum*, and *Botrytis cinerea*). Trials at the Idaho Agricultural Experiment Station indicate that carrot seed will tolerate ten minutes' treatment in hot water up to 136° F. but is seriously damaged at 142°. Aster yellows has been largely responsible for the decline of carrot and lettuce seed production on the Wilder Bench, the losses in the carrot crop in 1943 ranging up to 40 per cent. and averaging 10 to 15. In 1944 the damage was unimportant, but evidence was forthcoming of some current-season spread from the seed crop. 'Green dwarf', probably a virus of the aster yellows type, is characterized by a very stiff growth habit, thick, very dark green leaves, and late maturity.

Terrier (C.). **Méthode de préparation du blanc de Champignon de couche (Psalliota campestris).** [Mode of preparation of spawn of the hot-bed Mushroom (*Psalliota campestris*).]—*Annu. agric. Suisse*, lix, 10, pp. 949–952, 1945. [German summary.]

A method for the preparation of mushroom (*Psalliota campestris*) spawn devised at the Federal Experiment Station for Viticulture and Fruit Growing at Lausanne, consists essentially in the following processes [cf. *R.A.M.*, xxiii, p. 425]. The selected mushrooms are placed under a bell jar to open and sporulate, and the spores, falling on to a sterile glass slab, are transferred by means of a flamed scalpel to a test tube filled with sterile water. After dilution of the suspension to a suitable strength, the spores are sown in Petri dishes on Lambert's nutrient medium (*Mycologia*, xxi, pp. 332–335, 1922) [cf. *R.A.M.*, xx, p. 621] at 27° C. for germination. After 7 to 10 days the first germinated spores are subcultured in test tubes on 4 per cent. malt agar, and a fortnight later the mycelium will be sufficiently developed for removal to l. flasks containing 300 gm. sterile wheat. The inoculated flasks are laid in the incubator until the whole mass of wheat is permeated by the mycelium, which can then be used as spawn without any further treatment.

Morwood (R. B.). **Peanut diseases.**—*Qd agric. J.*, lxi, 5, pp. 266–271, 6 figs., 1945.

After pointing out that during the period 1934 to 1944, the groundnut crop in Queensland, as a result of routine seed treatment and the adoption of a seed distribution scheme based on crop inspections and individual plant selections, showed remarkable improvement as regards the incidence of disease, the author gives brief notes on the symptoms and control of the conditions known as seedling blight and crown rot (*Aspergillus* sp.), wilt (*Fusarium* or *Verticillium* sp.), leaf spots (*Cercospora personata* and *C. arachidicola*), and the virus diseases rosette (not so far recorded from Queensland), chlorosis, bunchy top, and leaf curl [*R.A.M.*, xix, p. 459].

Seedling blight and crown rot appears as a rot starting in the seed leaves and spreading to the stem. The rotting may produce a dry, shredded effect or may be wet and slimy. Breakdown of the stem may occur at any stage from germination to maturity. When the rot occurs early in germinating seed, the plants may not appear above ground. It may also develop in the germination trays. When well-grown plants are attacked by crown rot, they appear at first to be affected by a general wilt; the tissues just below ground-level are found to be dark, shrunken, and shredded; they often show the presence of black masses of spores of an *Aspergillus*. This is regarded as a weak parasite which enters the plant through

mechanical injury. Control consists in careful shelling and treating the kernels with ceresan or agrosan (1 oz. per 20 lb. seed for the Virginia Bunch variety and one-third this rate for Red Spanish).

MILLER (J. J.). **Studies of the Fusarium of Muskmelon wilt. II. Infection studies concerning the host range of the organism and the effect of environment on disease incidence.**—*Canad. J. Res.*, Sect. C, xxiii, 5, pp. 166–187, 2 pl., 7 graphs, 1945.

Continuing his studies on the causal fungus of muskmelon wilt (closely similar to *Fusarium bulbigenum* var. *niveum* f. 2) [*R.A.M.*, xxiv, p. 351], the author reports on the effect of environment on disease incidence, working with (*a*) a mixture of ½ loam, ¼ sand, ¼ leaf mould, (*b*) Vineland clay loam, (*c*) light sandy soil from knolls in (*b*) area, and (*d*) Vineland fine sandy loam.

In comparative experiments, six flats of each of these soils were used, three of which were sterilized, all being inoculated with oat-hull inoculum except the two controls that received only sterilized medium. Disease incidence (assessed on the number of seedlings that wilted) was seen to be consistently more severe in sterilized and less in the unsterilized soils. It is assumed that the reason for this may be that organisms in the unsterilized soils tended to hinder the activities of the pathogen. It was shown that the physical nature of the soil was not responsible for the variation in disease incidence, which differed considerably in the two sandy soils on the one hand, and in the leaf mould mixture and Vineland fine sandy loam, on the other.

The effect of various degrees of soil infestation on incidence was tested in dilution series ranging from 0 to 4 per cent. concentration of inoculum on sterilized and unsterilized soils, and the depressing effect on disease incidence of the competitive factor shown to be greater where the pathogen was added at the higher dilutions. It may be, therefore, that the action of other organisms in unsterilized soils arrests the development of the inoculum.

It was observed that even a low level of soil infection is able to cause severe wilt, which suggests the possible epiphytotic effects of small quantities of inoculum in a field, while the overwintering of quite small amounts of inoculum might prove enough to support the pathogen after it had become established.

Of 124 seedlings grown in naturally infested soil only one wilted after a month, although the pathogen was known to be present in the soil, and this again would seem due to the high sensitivity of the parasite to competing soil organisms, which tends to exercise a protecting effect on the host. Considerable stunting was, however, associated with this protection and is also attributed to biological causes, though there was no evidence that the wilt *Fusarium* is a material factor contributing to it. Soil-temperature studies in Wisconsin tanks showed a decrease in disease incidence above 30° C., but no minimum temperature was discovered below which the host grew well and escaped infection. Low soil moisture favoured a high disease incidence (90 as against 78 per cent.), and the seedlings grew better in the moist soil. The parasite as found in nature invariably exercised a more toxic effect than its cultural variants on all host varieties tested, and this points to the importance of employing the virulent wild type when infecting soils in resistance experiments.

STUBBS (L. L.). **The control of Celery leaf-spot in commercial nurseries.**—*J. Dep. Agric. Vict.*, xliii, 12, pp. 512–516, 4 figs., 1945.

The only celery disease of economic importance in Victoria is leaf spot (*Septoria apii-graveolentis*) [*R.A.M.*, xxiv, pp. 158, 305]. This has been a limiting factor to production in the Melbourne market-garden districts, where most of the Victorian celery is grown. Infection has been specially prevalent in early and late plantings,

when moist, cool conditions favour spread. The most popular variety grown locally, Golden Self Blanching, is highly susceptible.

In tests carried out in 1941–2 on Golden Self Blanching seed showing 70 to 80 per cent. infection, complete control was secured by treatment with various chemicals and also by hot water (118° F. for 30 minutes, and then soaking in cold running water for five), all treatments being followed by hot-air oven-drying at 90° for 15 hours.

In 1942–3, the most successful treatments were applied to bulk samples of seed. All were equally effective when the seed was sown immediately, but when it was stored for several weeks the chemical treatments caused a marked decrease in germinability. For the rest of the season and during the two following all celery seedlings produced in the same nursery (1942–3, 590,000; 1943–4, 640,000; and 1944–5, 740,000) were raised from hot water-treated seed, and all save two or three boxes (in one season) were completely free from leaf spot. All the seed was treated in a thermostatically controlled water-bath with a sensitivity of $\pm 0{\cdot}1°$ C.

Growers should expect some reduction in germinability as a result of the hot-water treatment. Seed two years old or more should not be treated. It should not occupy more than half the volume of the muslin bag, which should be weighted externally to ensure complete immersion. A more efficient container can be made from brass wire gauze. If more than 1 lb. seed is to be treated, it should be divided and each half treated separately. The temperature of the bath must be exactly 118° F. The container should be agitated for several minutes after immersion, and the bath stirred from time to time during the treatment. After 30 minutes exactly, the seed should be spread out to dry rapidly in a thin layer on an absorbent surface. A suitable wind-tunnel to facilitate drying can easily be made with an electric fan and a heating element.

Roland (G.). **Sur une microméthode sérologique pour l'étude des viroses végétales.** [On a serological micromethod for the study of plant virus diseases.]—*Parasitica*, i, 3, pp. 106–112, 1 pl., 1945. [Flemish summary.]

In this account of a study of Stapp's method for the identification of viruses (*Mitt. biol. Anst.* (*Reichsanst.*), *Berl.*, lxvii, p. 9, 1943) [*R.A.M.*, xxiii, p. 496], the author states that Stapp uses as the antigen source tobacco plants inoculated with the virus of which it is desired to prepare the anti-serum. Three to five weeks after inoculation the juice is extracted, treated, centrifuged, and the virus obtained in a strong concentration in a physiological salt solution or Ringer's solution. This solution is then inoculated into rabbits and the serum obtained, which is then used by a rapid and easy drop-precipitation method. To secure the micro-sero-reaction, potato leaflets or pieces of tobacco leaf are pressed, and the juice allowed to run into a centrifuge tube. An equal volume of 0·5 per cent. sulphate of soda or physiological salt solution is added, the mixture centrifuged and decanted, and a drop placed on a slide with a drop of anti-serum. When the two drops have mixed the slide is maintained at 23° C., for 20 to 30 minutes. A positive reaction is shown by the appearance of a flocculent precipitate.

The results obtained showed that while the method may be used on different species of plants and at any season for the detection of potato virus X, this is not the case with viruses Y and A. The anti-virus Y serum gave negative results on potatoes in the field, though most of the time the plants showed characteristic symptoms. The anti-virus A serum sometimes gave distinctly positive reactions on potatoes infected with A but the reaction was frequently weak or lacking.

The paper concludes with a note on certain modifications of Stapp's method introduced by the author, as regards the production of anti-virus X serum; these concern the choice of plant to be used as a source of the virus, and the number of injections made in the rabbit.

CIFERRI (R.). **Relazione sul' attività del R. Laboratorio Crittogamico e del R. Osservatorio Fitopatologico durante l'anno 1942.**—[Report on the activity of the Royal Cryptogamic Laboratory and the Royal Phytopathological Observatory during the year 1942.]—*Atti Ist. bot. Univ. Pavia*, Ser. 5, i (1), pp. 7–83, 16 figs., 1943. [Received February, 1946.]

This report on plant disease work at Pavia in 1942 contains, *inter alia*, the following items of interest. A specimen of lucerne from Tripolitania showed the presence of the mycelium of *Rhizoctonia violacea* [*Helicobasidium purpureum*], together with the pycnidia of a fungus resembling the description of *Phoma roseola*, except that the spores were rather smaller, averaging 4 by 3 μ.

Observations on vine mildew (*Plasmopara viticola*) in several localities showed that primary infection is not always on the lowest branches, as at Canneto the oil spots of the first infection occurred at 1·5 m. from the ground. The formation of the oil spots and the development of the fungus are often so closely associated with microclimatic conditions that the progress of the disease seems to differ from one vineyard to another. Attacks on the fruit clusters were particularly severe in 1942; sometimes the relation between the outbreak and rainfall was clear, at others it was not, and infection seemed to be associated with particular races of the fungus able to attack the bunches even in moderately dry conditions. In June and July, mildew was often observed on the leaf veins without the preceding oil spots.

Oleander branches from Tripoli showed swellings due to *Bacterium tonellianum* [*R.A.M.*, xix, p. 582]. Dates, also from Tripoli, were affected by mould due to *Aspergillus phoenicis* [ibid., x, p. 184; xxii, p. 468], a fungus previously observed by the author on cacao fruits in the Dominican Republic.

Dark spots with blackish to reddish shading on woollen material were shown by inoculation experiments to be due to *A. niger* and *A. fumigatus*. Positive results were obtained only on wool kept in damp conditions.

CIFERRI (R.). **Relazione sull' attività del Laboratorio Crittogamico, dell' Osservatorio Fitopatologico e del Centro Studi Anticrittogamici durante l'anno 1943.** [Report on the activity of the Cryptogamic Laboratory, the Phytopathological Observatory, and the Centre for Fungicidal Studies during the year 1943.]—*Atti Ist. bot. Univ. Pavia*, Ser. 5, i (4), pp. 279–362, 10 figs., 1944. [Received February, 1946.]

This report [cf. preceding abstract] contains, *inter alia*, the following items of interest. Studies on foot rot of wheat from various parts of Italy showed that the most important causal fungus was *Ophiobolus graminis*. On the wheat from Florence it was found in 86, 76, and 91 per cent. of the specimens examined in 1938, 1939, and 1941, respectively. Wide differences in susceptibility were observed, *Triticum vulgare*, *T. compactum*, *T. turgidum*, *T. durum*, and *T. polonicum* being susceptible, *T. dicoccum* and *T. spelta* less so, while *T. monococcum* was virtually immune, and *T. abyssinicum* showed wide variability from one strain to another. As regards the soft wheats, the early varieties were the most susceptible, the intermediate ones less so, while the semi-late ones were more resistant than the late. The Strampelli strains generally displayed high or very high susceptibility, as did also the various strains of Società Produttori Sementi di Bologna; Frassineto and Avanzi were moderately resistant, and the Todaro strains highly so. *O. graminis* seems to appear every year in every wheat field, whatever the strains grown or the cultural conditions, but the damage caused varies greatly from year to year and from field to field. Injury is serious only when the fungus becomes established on the collar of the stem, and is more serious the earlier this happens; the condition is also aggravated by unfavourable growth conditions.

Cercosporella herpotrichoides in 1938 caused 7 per cent. of the cases of foot rot examined at Florence, the figures for 1939 and 1940 being 13 and 3 per cent.,

respectively. Most of the damage is produced during winter. Of the species of *Fusarium* associated with wheat foot rot, one of the commonest was *F. graminearum* (*Gibberella saubinetii*) [*G. zeae*].

Soft wheat bunt, due to *Tilletia tritici* [*T. caries*] and *T. levis* [*T. foetida*] is virtually absent from south-central Italy and the islands, and usually causes no appreciable losses in the north, though some recent recrudescence of infection occurred in Lombardy. The absence of bunt in southern and insular Italy is attributed to the relatively high autumn and spring temperatures and to the high resistance of the *Triticum durum* and *T. turgidum* wheats grown.

Watermelons affected by fruit rot showed the presence of a *Sclerotinia*, possibly *S. minor*, an unidentified bacterium, a *Phytophthora*, (?) *P. erythroseptica* (once), and *Pythium debaryanum*. Inoculations of experimentally wounded watermelons with the last-named fungus gave positive results.

Wilted maples (*Acer campestre*) showed the presence of *Armillaria imperialis*, apparently semi-parasitic. This species has recently been placed by R. Singer (*Rev. Mycol.*, N.S., v, 1, pp. 9–10, 1940) in *Catathelasma*, identified with the later genus *Biannularia*, which becomes a synonym.

A leaf spot of groundnuts, accompanied by loss of yield, was caused by potassium deficiency.

Digitalis purpurea and *D. lanata* at Pavia were affected by anthracnose due to *Colletotrichum fuscum* [*R.A.M.*, xvii, p. 822].

In 1937 and 1938, stocks (*Matthiola incana* var. *annua*) were attacked by *Bacterium campestre* [*Xanthomonas campestris*: ibid., xi, p. 517; xxiii, p. 283]. The possible identity of this organism with *Bact. matthiolae* [ibid., xvii, p. 459] is briefly discussed.

Spots on the floral swathes of *Anthurium scherzerianum* in a greenhouse at Pavia showed the presence of *Fusoma calidariorum*, a saprophyte which under certain conditions can probably become to some extent parasitic.

Cardboard boxes affected by moulds which made them commercially useless showed the presence of a *Monilia* of the *M. aurea* group, a *Penicillium* of the *P. crustaceum* group, an *Aspergillus* of the *A. niger* group, an *Aspergillus* of the *A. fumigatus* group and, occasionally, an *Aspergillus* of the *A. flavus* group. The manufacturers were recommended to disinfect the cardboard with nitrobenzolene or by formaldehyde fumigation, if they did not wish to use paraffin; to use starch adhesive as much as possible instead of casein, and to make the adhesive with thymolized water.

Agricultural research.—*Rep. imp. Coun. agric. Res., Delhi, 1944–5*, pp. 1–11, 1945.

On p. 3 of this report [cf. *R.A.M.*, xxiv, p. 7] it is stated that the scheme for the suspension of wheat and barley cultivation in the Nilgiris and Palni hills, sanctioned for three years from March, 1943, to ascertain whether such a step would control wheat rusts [*Puccinia graminis*, *P. glumarum*, and *P. triticina*] in the plains of southern India [loc. cit.] was continued during the period under review; it is, however, to be terminated on the completion of its second year, owing to the heavy cost of the compensation to be paid to growers. To produce a nucleus of virus-free potato 'seed', a central station has been started at Kufri in the Patiala State at a cost of Rs. 94,300 for five years. New virus diseases collected included yellow-vein mosaic of *Althaea rosea*, yellow mosaic of beans (*Phaseolus vulgaris*) and *P. aureus*, and a green mosaic of *Lilium longiflorum*; groundnut rosette [ibid., vii, p. 486] was also collected in connexion with a study of the insect vectors. A scheme for the maintenance of fungus cultures in India is in operation at the Imperial Agricultural Research Institute, New Delhi, the collection now comprising 423 cultures [ibid., xxii, p. 216].

On p. 13 it is stated that in a test of the relative susceptibility to smut [*Ustilago scitaminea*] of sugar-cane varieties by dipping the setts into a spore suspension of the fungus, 18 were fairly resistant, 18 moderately susceptible, and 72 highly susceptible. Exposure of affected setts to a temperature of 55° to 60° C. for 10 minutes fully controlled infection, but greatly reduced germination.

URQUHART (D. H.). **Report on the Department of Agriculture, Gold Coast, for the year 1944–5.**—8 pp., 1945.

This report [cf. *R.A.M.*, xxiv, p. 93] states that cacao swollen shoot [ibid., xxiv, pp. 307, 352] has spread from the original focus some miles west of Koforidua in the Eastern Province westward to the Central Province boundary and north-west up to the Eastern Scarp as far as the Ashanti boundary. From the original focus in the Western Province round Wiawso general spread has occurred eastwards to the Ancobra river, down the valley of the Tano river, and westward on to the French border. In the French Ivory Coast, the northern outbreak is about 10, and the southern about 15, miles from the nearest Western Province outbreaks. Between the Eastern Province and the Western Province areas is a chain of outbreaks, of which the most northerly is the isolated outbreak at Efiduasi. The chief Ashanti cacao districts are virtually unaffected, while the Central Province is also healthy, except for patches on the remote boundaries.

Further tests of cutting out diseased cacao indicated that spread was arrested by removing the infected trees only, as soon as the condition develops, providing every fresh infection is immediately eradicated. Prolonged drought killed patches of cacao in parts of the Eastern Province.

A dying-off of the lateral roots of young lime trees and of the shoots on one side of the trees was associated with *Ganoderma lucidum* and a species of *Trametes*, both of which were prevalent on the dead trees. A detailed survey of budded lemon, orange, grapefruit, and tangerine trees at Asuansi confirmed the greater resistance of rough lemon as compared with sour orange stocks.

[DEIGHTON (F. C.).] **Plant pathology.**—*Rep. Dep. Agric. S. Leone, 1944*, p. 9, 1945.

In this report [cf. *R.A.M.*, xix, p. 692] it is stated that during 1944 four further records of rust (*Uromyces appendiculatus*) on climbing French beans [*Phaseolus vulgaris*] were made in European vegetable-gardens in the Colony of Sierra Leone, and at Kailahun and Njala in the Protectorate. The disease appears to have been introduced on seed from South Africa and, earlier, from the Gold Coast. Maize rust (*Puccinia sorghi*) was recorded for the first time in Sierra Leone, at Bo, where it was doing little harm. A streak disease, presumably of virus origin, was noted on *Pennisetum purpureum* and *Chasmopodium caudatum*, though Guinea grass [*Panicum maximum*] and *Andropogon tectorum* in the vicinity were unaffected.

WIEHE (P. O.). **Division of Plant Pathology.**—*Rep. Dep. Agric. Mauritius, 1944*, pp. 11–12, 1945.

In this report [cf. *R.A.M.*, xxiv, p. 137] it is stated that sugar-cane red rot [*Physalospora tucumanensis*: ibid., xxv, p. 233] was more prevalent in Mauritius during 1944 than during previous years on M. 134/32, as a result of a cyclone experienced in April. New records for the period under review include *Sclerotinia sclerotiorum* on *Brassica chinensis* and *Colletotrichum gloeosporioides* on orchids (*Rhynchostylis* sp. and *Dendrobium chrysotoxum*), causing a leaf spot and blight.

Science for the Farmer.—*Rep. Pa agric. Exp. Sta., 1944–5* (*Bull.* 475), 48 pp., 10 figs., 1 graph, 1945.

This report [cf. *R.A.M.*, xxiv, p. 51] contains the following items of phytopathological interest. In a test of 97 unsprayed potato varieties grown in 30-hill

lots, one strain immune from blight [*Phytophthora infestans*], bred by W. R. Mills, yielded at the rate of 239 bush. per acre. Sequoia, Russet Rural, and Katahdin under comparable conditions gave, respectively, 229, 112, and 109 bush. per acre.

R. D. Anthony reports that where peach potash deficiency [cf. ibid., xxiii, p. 233] had been most serious, annual applications of 400 to 500 lb. muriate of potash per acre were necessary. Work in progress by C. D. Jeffries indicates that in general where a low potash feldspar content and an illite type of clay occur, liberal potash dressings are necessary in peach orchards, though where a high feldspar content and a kaolinite type of clay are present, response to normal potash applications is satisfactory.

D. E. H. Frear, H. J. Miller, and H. W. Thurston found that structural changes in the 'speed' sprayer [ibid., xxiv, p. 63] greatly improved its performance. The high-pressure sprayer produced slightly more packed fruit and slightly fewer culls than the speed sprayer. The time required for spraying each tree was much less for the speed sprayer, though it used an average of 24 gals. spray per tree, as against 14·5 gals. for the high-pressure equipment.

F. H. Lewis reported that fermate, alone or in combination with sulphur, gave improved control of apple rust [*Gymnosporangium* spp.]. The fermate-sulphur mixture offers a new method of rust control with no sacrifice of other features of the apple spray programme [cf. ibid., xxiv, pp. 265, 319, 404].

BREMER (H.). **Über Welkekrankheiten in Südwest-Anatolien.** [On wilt diseases in south-west Anatolia.]—*Istanbul Yaz.* 18, 40 pp., 13 figs., 1 map, 1944. [Received April, 1946.]

During a period of 2½ years spent at the Plant Protection Station of Izmir, south-west Anatolia, Turkey, the writer was impressed by the economic importance of the wilt diseases of cultivated plants, notably tobacco, sesame, and anise, while other crops commonly affected include cotton, eggplant, melon, potato, and various legumes. Epidemics of tobacco wilt occurred in 1935 and 1938, the total reduction in the harvest of the latter year from this source being roughly computed at 6 per cent. The external symptoms of the disease are those of a typical wilt, but a section through the interior of a stem with a discoloured constriction, 3 to 4 cm. in length, prolonged on one side into a narrow strip 10 cm. long, revealed a co-extensive blackening and collapse of the inner cortex. Only in the central portion of the infected area was the xylem also involved, and here the cortex and the adjoining vessels contained a multiseptate mycelium, 4 to 8 μ in diameter, minute, black sclerotia being also present in the rind. A typical symptom of the advanced stage of the wilt is the shrivelling and desiccation of the medulla. The tap-root of the diseased plant was healthy, but the larger lateral roots were mostly shrivelled and somewhat discoloured. Infection obviously proceeds from the cortex and is more or less restricted to the root system and stem base, so that the disease cannot be assigned to the group of tracheomycoses, a salient feature of which is the vascular discoloration ascending from the roots; it also differs from a number of other well-known diseases characterized by wilting. Isolations from the root system of diseased plants yielded *Fusarium scirpi* (already reported by Forsteneichner as a secondary parasite of cotton following primary infection by *Rhizoctonia gossypii* [var. *anatolica*: *R.A.M.*, x, p. 788]), *F. solani*, and *Macrophomina phaseoli* [ibid., xviii, p. 634]. Inoculation tests with the three fungi gave inconclusive results as regards the development of wilting, but their admixture with the soil reduced the average height of the seedlings (50 for each pathogen) after 23 days from 5·4 to 2·5 (*F. solani*), 3·5 (*F. scirpi*), and 4·1 (*M. phaseoli*) cm., respectively. When cut plants in the 5- to 6-leaf stage were placed in test tubes containing Richards's solution staled by 50 days' growth of the organisms (four plants for each), the same order of pathogenicity was observed, *F. solani* causing complete loss of turgor in three

and partial in one, the position in the case of *F. scirpi* being exactly reversed, while *M. phaseoli* partially affected only one.

The fungi in question having been thus shown to act as purely facultative parasites, an investigation was made of the conditions favouring outbreaks of the wilt. Plants do not contract infection until they are about to flower, a fact that probably accounts to a large extent for the failure of greenhouse inoculations. In none of the three years covered by the author's observations were appreciable numbers of wilted plants seen before July. Recovery does not ensue and the percentage of infected or dead plants rises steadily during the summer. Late planting was shown to decrease the amount of wilt developing by early September from 98·1 per cent. in a plot set out on 21st March to 46·2 in one planted on 10th May. Harvesting of the leaves was found to favour the wilt, 96 per cent. of the plants stripped of their foliage in a random sampling in 1939 being affected compared with 64 per cent. of those left intact. Watering of tobacco is usually omitted for fear of impairing the quality of the leaf, but four small test plots were watered a few times in 1938 with the result that only 34 plants wilted compared with 119 in those kept dry. The disease assumes a particularly severe form when there is a dry early summer, such as those of 1935 and 1938, and is mild when there is more rainfall, e.g., in 1939 and 1940. The wilt is confined to south-west Anatolia, where the summer climate is the driest in Turkey, and it is apparent from the foregoing that it is predominantly a concomitant of drought.

Cultural measures likely to reduce the incidence of the trouble are impracticable, and the only possibility of control at present lies in the development of resistant selections, such as Bornova, the incidence of infection in which in 1939 ranged from 0 (planting of 3rd May) to 72·6 (5th April) compared with an average for all plants of 76·2 (10th May) to 95·7 (31st March).

The sesame wilt presents close parallels with that of tobacco both as regards symptomatology, time of development, and the favouring influence of drought. Moreover, *M. phaseoli* and *F.* (?) *solani* were isolated from most of the specimens of diseased material, presumably in a secondary capacity since inoculation experiments were again unsuccessful. Similar observations were also made in connexion with the anise wilt, with which *M. phaseoli*, *F.* (?) *scirpi*, and *F.* (?) *solani* were associated. This crop was further attacked, after an abnormally rainy spell in June, 1940, by *Cercospora malkoffii* [ibid., xi, p. 73], causing a brown or black discoloration and desiccation of the leaves and flowers.

M. phaseoli was isolated from the one case of potato wilt [cf. ibid., xxiv, pp. 96, 202] examined, which occurred in an unwatered plot in July, 1939.

A specimen of wilted cotton submitted for inspection in August, 1938, again yielded *M. phaseoli* and an unidentified *F.* sp. Tracheomycosis due to *Verticillium* was twice observed in other districts in the damp summer and autumn of 1940.

In August, 1940, *F.* (?) *solani* was isolated from the lateral roots of eggplants at Ankara, central Anatolia, suffering from a wilt of the 'dry' type predominating in the south-western part of the province. The same host in the latter region in 1939 was affected by a typical tracheomycosis caused by an undetermined *F.* sp.

Two fields of melons showed conspicuous bare patches in July, 1939, the sites of infection by a *Fusarium* with conidia measuring 7 to 44 by 2·5 to 5 μ, which was isolated from the interior of the roots. The vessels of the tap-roots contained an abundance of mycelium, which was whitish-yellow in pure culture on broad bean stems. Infection is believed to have emanated from the soil.

Ascochyta pinodella was responsible for wilt and black-leg of broad beans and peas, while a *F.* sp. and a *Cephalosporium* were isolated from necroses in the root system of chick peas (*Cicer arietinum*) with pallid stem bases to which dark, irregular, scab-like lines and depressions imparted a 'cauterized' appearance. Legumes are mostly grown in south-west Anatolia as winter crops, and their

pathogens thrive under cold, damp conditions. This type of wilt, which involves entire stands, is essentially a juvenile disease, but another form develops sporadically in April or May. In this case neither cold nor drought can be implicated in the etiology of the trouble, and its only connexion with the group of wilts due primarily to aridity is the occurrence of both at flowering time.

Greaney (F. J.) & Machacek (J. E.). **The prevalence and control of seed-borne diseases of cereals.**—*Sci. Agric.*, xxvi, 2, pp. 59–78, 1 map, 1946.

Examination of over 3,000 farm samples of cereal seed from the 1937 to 1942 crops from all parts of Manitoba showed that, of the fungi isolated, *Helminthosporium sativum* on wheat, barley, and rye, *H. avenae* on oats, and *H. teres* on barley predominated. *Fusarium culmorum* and *F. graminearum* [*Gibberella zeae*] were not common.

Infection tests in non-sterile soil clearly indicated that wheat and barley seeds infected by *H. sativum* give a corresponding occurrence of disease in the subsequent seedling stands. In wheat, though not in barley, seed infection by *H. sativum* was associated with low germination.

Of 1,710 wheat samples examined from the 1939 to 1942 crops, only 3·4 per cent. carried more than a trace of bunt (*Tilletia tritici* [*T. caries*] and *T. levis* [*T. foetida*]). Of 518 oat samples 75·9 per cent. had sufficient loose and covered smut (*Ustilago avenae* and *U. levis* [*U. kolleri*]) to render seed treatment necessary. Of 747 barley samples, 72·7 per cent. showed enough covered smut (*U. hordei*) and false loose smut (*U. nigra*) to require seed treatment. These results indicate that seed treatment, particularly of oats and barley, is not being adequately carried out in Manitoba.

The amount of infection caused by seed-borne diseases varied appreciably from locality to locality and from year to year, depending largely upon the particular environmental conditions under which the seed was produced and on the variety of seed grown. Some parts of Manitoba are better suited than others for the production of healthy cereal seed.

Several years' field observations showed that when climatic conditions favour early ripening and harvesting, infection by seed pathogens is low, whereas if warm, humid weather prevails the infection incidence is high.

When infected samples of wheat, oat, and barley seed were treated in greenhouse tests with dilute ceresan dust (5 per cent. ethyl mercury phosphate), almost complete control of seed-borne diseases due to *Helminthosporium* and *Fusarium* spp. was secured. It improved the germination of infected wheat and oat seed, but not that of healthy seed. The treatment of healthy cereal seed is unnecessary unless the seed is sown in heavily infested soil.

The survey demonstrated that in Manitoba nearly 25 per cent. of the seed stocks of wheat, and over 80 per cent. of those of oats and of barley examined from the 1939 to 1942 crops carried disease organisms in sufficient amounts to require seed treatment, the most important organisms being the surface-borne smuts of oats and barley. It is strongly urged that all seed of oats and barley grown in Manitoba should be treated with an approved disinfectant before being sown.

Jenkins (Anna E.). **Saint-Hilaire's records of damage from Wheat rust in Brazil.**—*Chron. bot. Cal.*, ix, 2–3, pp. 147–150, 1945.

Reference has already been made by Grillo (*Rodriguésia*, ii (num. esp.), pp. 109–113, 1936 (issued 1937) and Puttemans [*R.A.M.*, xx, p. 314] to Saint-Hilaire's records of damage from wheat rust in Brazil. In the present paper (*Symbolae phytohistoricae*, No. 7) the writer details all the references to rust, citing in the original French excerpts from the 'Voyages dans l'intérieur du Brésil (1816–1822)', Paris 1830–51, and 'Voyage à Rio Grande do Sul containing the report of his second

trip to Minas and S. Paulo', Orléans, 1887, relating to the occurrence of the disease and mentioning the existence of resistant varieties. In the opinion of Dr. H. B. Humphrey, the species concerned was probably either *Puccinia graminis* or *P. glumarum*.

VALLEGA (J.). **Razas fisiológicas de Puccinia rubigo-vera tritici, comunes en Argentina.** [Physiologic races of *Puccinia rubigo-vera tritici* common in Argentina.]—*An. Inst. fitotec. S. Catalina, 1942,* iv, pp. 40–57, 1 graph, 1 map, 1944. [English summary.]

Physiologic races 5, 13, 20, 26, 49, 57, 62, 105, and 114 of *Puccinia rubigo-vera tritici* [*P. triticina*] were observed in the wheat-growing regions of Argentina between 1938 and 1942 [*R.A.M.*, xxiv, p. 223]. In 1939, 1940, and 1941, race 20 was the most prevalent, but in 1942 race 49 was equally widespread, 13 coming next in frequency, while the remainder were only detected sporadically, and almost invariably as an insignificant admixture with other races.

From the standpoint of breeding wheat resistant to *P. triticina*, the Argentine races may be classified in two groups with well-defined characters of pathogenicity and abundance. The first, comprising 20, 49, 13, and 26, is the most commonly encountered; this group does not attack the differential varieties Mediterranean, Democrat, and Sinovalocho. The second is composed of races 5, 62, 57, 105, and 114, all of which are highly pathogenic to the same three varieties. Generally speaking, at any rate as regards the period under review, the latter group, in spite of its virulent constituents, does not decisively influence the liability of the cultivated varieties to brown rust, which is almost exclusively dependent on their reactions to the races included in the former. It might, therefore, seem sufficient to concentrate on the cultivation of varieties resistant to the races of group (1), but it would be inadvisable to neglect the provision of factors of resistance to the less common races of (2), which at any time might spread and basically modify the reactions of the varieties now deemed to be resistant.

One of the difficulties incidental to this investigation lay in the variable responses of the differential varieties, Carina, Brevit, and Hussar, to races 13, 20, and 49 of *P. triticina*, which complicated the work of identification.

SIMMONDS (P. M.) & SALLANS (B. J.). **Testing Wheat seedlings for resistance to Helminthosporium sativum.**—*Sci. Agric.*, xxvi, 1, pp. 25–33, 1 fig., 1946.

In these analytical studies, designed to assess rapid methods for testing the susceptibility of wheat seedlings to *Helminthosporium sativum* [*R.A.M.*, vii, p. 301; xvii, p. 668], reliance was placed mainly on the test-tube method for most varieties of seeds tested, care being taken to select seed of high viability and quality. The temperature considered most suitable, pending further inquiry, was 24° C. and incubations of seedlings in dark and light did not suggest any appreciable difference in their effectiveness. The tubes were fitted with strips of blotting paper at about 2 in. from the top of the tube so as to provide a shelf on which the seeds inoculated by a conidial suspension were laid. Petri dishes fitted with moistened filter paper, on which the seeds were laid in rows, were used as a second method. The incubation period was five days.

Marquis, Thatcher, Red Bobs, and Apex (most resistant of the Canadian varieties) were shown to be more resistant than Pelissier, Renown, Mindum, and Regent, the last two being most susceptible. Infection varied from 9·6 and 18·6 per cent. for Marquis and Thatcher, respectively, to 83 and 88·3, respectively, for Regent and Mindum. Thatcher was regarded as the most consistently resistant wheat tested. Marquis and Red Bobs have also shown a high average of general performance over several years. Evidence on the parental material represented by Red Bobs and Marquis was confined to a small test with Red Fife, in which it

disclosed moderate to low susceptibility. Seedling tests with Marquis, Kanred, and Jumillo wheats, which figure in the heredity of Thatcher, showed useful to good resistance in the first two, but Jumillo came out indifferently in one trial. H-44-24 × Double Cross, the parental strains of Apex, tested well for resistance, the Double Cross hybrid employed in this test undoubtedly being of the same Thatcher origin and a near cognate of, if not identical with, the same hybrid used in the original Apex cross. The poor showing of the Canadian varieties Renown and Regent, may reflect the presence of Reward in their pedigrees. The value of high quality seed is emphasized by the fact that there was considerable failure to germinate in some wheat, notably with old seed, and mouldiness in some seed and increased blighting after inoculation is thought to suggest the wisdom of preparing a formula for the estimation of disease.

A comparison of varieties, using greenhouse-grown seed possessing uniform quality, confirmed Thatcher as the most resistant, with Marquis and Apex next, and Reward the least. The usefulness of a similar test, using the Petri dish method, illustrated the means of establishing a disease-rating formula, 25 seeds being sown per dish, the results being usually obtainable on the fifth day for classification and estimation as follows: clean, 0; coleoptile lesions present, trace, 1; slight, 2; moderate, 3; and severe, 4. The disease rate was calculated on McKinney's formula [ibid., iii, p. 330]. Provided that complications with rapid mould development do not occur, the method is quite adequate. A disease rate based on weighted degrees of lesions offers a more precise estimation of border-line cases and is also applicable to the test-tube method. Further study of Little Club variety, which tested fairly well in other trials, but came poorly out of this last experiment, is thought desirable.

SIMMONDS (P. M.). **Detection of the loose smut fungi in embryos of Barley and Wheat.**—*Sci. Agric.*, xxvi, 2, pp. 51–58, 2 figs., 1946.

Barley and wheat loose smuts (*Ustilago nuda* and *U. tritici*, respectively), while not usually of great economic importance in Canada, are a source of trouble, particularly to seed-growers. Both cause considerable loss when incidence is high, are difficult to detect in seed samples, and also to control. Every year in western Canada a few barley fields show up to 20 per cent. of the plants infected by *U. nuda*.

Two methods of detecting embryo infection are described. The embryos are first removed with sodium or potassium hydroxide solutions. In the whole embryo method they are allowed to remain in an excess of water for 12 to 15 hours, then in 95 per cent. alcohol for an hour or two, and finally in one or two changes of absolute alcohol. The sample is cleared in thick cedar-wood oil. Examination of the scutellum under a 70 × binocular shows the brownish mycelium in contrast to the transparent host cells. Often the whole scutellum is involved or foci are commonly present in the apical or lateral parts, particularly in the epithelium, but the invasion also affects the adjacent parenchyma. In cases of doubt, the embryo can be dissected and examined in greater detail.

In the sectioned embryo method, the specimens are transferred from the water to 70 or 85 per cent. alcohol, then through the usual butyl-ethyl alcohol solutions, about two hours in each, to pure butyl alcohol. The embryos are then embedded in paraffin wax at 55° C. in small porcelain trays; upon gentle agitation they arrange themselves in layers and sufficient material representing each layer is microtomed. The slides are stained in Harris's haemotoxylin ($\frac{1}{2}$ hr.) and in 5 per cent. aqueous Congo red (3 hours), and mounted in balsam. The hyphae stain readily with Congo red and are easily detected. In a test with Glacier barley, field notes (counts based on smutted heads), a greenhouse test (about 200 plants, percentage based on number of smutted plants), and both embryo methods

(100 to 300 examined) agreed in giving, respectively, 21, 21, 20, and 18 per cent. infection. With Newal barley (Indian Head), the corresponding figures were 20, 14, 14, and 11 per cent.

NEWTON (MARGARET), PETURSON (B.), & MEREDITH (W. O. S.). **The effect of leaf rust of Barley on the yield and quality of Barley varieties.**—*Canad. J. Res.*, Sect. C, 6, xxiii, pp. 212–218, 1945.

The data on which the tabulated results of these experiments are based extend over one year only, 1941, when the investigation had to be suspended. Two types of six-rowed barley were used, O.A.C. 21 and Mensury, possessing high malting quality, and Chevron, Peatland, Regal, and Plush, of lesser malting quality. Each variety was grown in 12 randomized plots, each of three rod rows spaced 1 ft. apart. Plants of sub-blocks containing one plot of each variety were infected with leaf rust (*Puccinia anomala*) at the five-leaf stage of development. The plants in uninfected control sub-blocks were dusted three times weekly and after heavy rain with kolodust sulphur preparation at a dosage of 30 lb. per acre per application in order to prevent rust attack. Composite samples of each variety from the controls and from the inoculated plots were graded for malting quality at the Malting Laboratory of the University of Manitoba.

All the artificially infected plants were severely attacked by rust, but there were only insignificant evidences of the disease in the dusted plots and scarcely any trace of stem [black] rust [*P. graminis*]. The yield (kernel and bushel weight) of all six varieties tested showed depreciation, the two high-grade varieties, O.A.C. 21 and Mensury, showing stronger resistance to the disease than the other four. Decrease in yield was not always proportionate to the incidence of the disease as measured by leaf rust percentages, which, in the case of Mensury and Plush, was much the same, although Mensury showed little reduction in yield while that for Plush fell considerably. This cannot be accounted for by differences in the time of maturity, for Mensury, one of the earliest, ripened only two days before Plush, the latest maturing variety of those tested. Also the incidence of *P. anomala* was at its peak on all six barleys some two weeks before they attained maturity, this differential response confirming Caldwell and collaborators' finding [*R.A.M.*, xiii, p. 754]. The toleration of rust disease by some cereal varieties better than others has yet to be explained.

In general, however, the results clearly showed that an attack by *P. anomala* on barley need not be epiphytotic in order to cause very considerable damage, and where the climatic conditions are such as to favour this pathogen it is regarded as dangerous to plant susceptible varieties.

The effects of *P. anomala* on the malt extract, diastatic power, and wort nitrogen properties of malt were studied in the light of the work of W. O. S. Meredith and J. A. Anderson as recorded in *Canad. J. Res.*, Sect. C, xvi, pp. 497–509, 1938. Since a fall in barley nitrogen content and an increase in malt extract usually go together, in the case of the six samples tested here it might be expected that the loss in kernel weight would be followed by a comparable fall in malt extract. Yet the weight of malt extract recovered from the samples was, on the whole, rather higher than these expectations, and markedly so in the case of Regal, which showed far less loss of malt diastatic power than was suggested by the differences in nitrogen content observed. The known deficiency of this variety in enzymes would account for its not modifying well in the course of malting. In view, however, of the fact that the sample from the rusted Regal plots, and also those of other varieties used in these studies modified reasonably well in spite of the effect of rust incidence on the barley properties, suggests that rust may have acted on the carbohydrate materials of the barley in such a way as to make malt extract more readily available.

FERNANDEZ VALIELA (M. V.). **La presencia del 'Helminthosporium avenae' en la República Argentina.** [The presence of *Helminthosporium avenae* in the Argentine Republic.]—*Rev. argent. Agron.*, xii, 4, pp. 281–284, 3 figs., 1945.

Helminthosporium avenae was isolated in pure culture from oat seeds in a fodder mixture in 1942, this being the first authentic record of its occurrence in Argentina. The fungus made good growth on 1 per cent. potato dextrose agar, but sporulation was obtained only on oat dextrose agar at the same concentration: the perithecial stage (*Pyrenophora avenae*) [*R.A.M.*, xiv, p. 690] did not develop. Soil inoculation experiments on oat seedlings resulted in stunting, darkening of the roots and destruction of the root hairs, and basal constriction and necrosis, frequently leading to the death of the plants before heading. Leaf spots were not observed.

BÉKÉSY (N. v.). **Kleine Impfmaschine für parasitische Mutterkornkultur.** [A small inoculating machine for parasitic ergot culture.]—*Zbl. Bakt.*, Abt. 2, cvi, 20–24, pp. 474–479, 1 fig., 2 diags., 1944.

Full particulars are given of a small machine for inoculating rye with individual rye ergot [*Claviceps purpurea*] strains from selected sclerotia with a high alkaloid content [*R.A.M.*, xxv, p. 65], which has given very satisfactory results in small-scale trials in Hungary. For the treatment of 1 ha. a period of 15 to 25 working days is required, in the course of which yields of 170 kg. or upwards may be obtained. The alkaloid content of individual sclerotia was shown in an earlier study to vary greatly [ibid., xix, 273], and it has since been ascertained that in Hungary the fungus comprises two races, one of which is rich, and the other poor, in alkaloids.

VALLEGA (J.). **Observaciones preliminares sobre especialización fisiológica de Puccinia sorghi, en Argentina.** [Preliminary observations on physiologic specialization in *Puccinia sorghi* in Argentina.]—*An. Inst. fitotec. S. Catalina, 1942*, iv, pp. 14–16, 1 pl., 1944. [English summary.]

A preliminary study of the population of maize rust (*Puccinia sorghi*) in the Llavallol district of the province of Buenos Aires indicated the presence of two physiologic races [*R.A.M.*, xiii, p. 573], viz., A, inducing only the type 0 reaction (necrosis) on strain 41.3040, and B, which is highly pathogenic to the same (type 4 reaction). Both in 1942 and 1943, race B was very scarce round Llavallol; this, no doubt, accounted for the paucity of observations of *P. sorghi* on 41.3040 in the field.

MEHTA (P. R.) & BOSE (S. K.). **A leaf-spot disease of 'Jowar' (Sorghum vulgare Pers.) hitherto unrecorded from India.**—*Curr. Sci.*, xv, 2, pp. 49–50, 5 figs., 1946.

During the past few years, sorghum growing in the vicinity of Cawnpore, India, has been rather seriously affected by leaf spot due to *Titaeospora andropogonis* [*R.A.M.*, xxv, p. 65], not previously recorded from India. First noticeable in the third week of July when the crop is moderately young, it assumes a virulent form towards the end of August. The young lesions are elongate-elliptic, amphigenous, naphthalene-yellow at first, changing to Naples yellow and finally to capucine buff. As the spots mature, the central portion darkens, becoming grey and ultimately sooty, surrounded by a flesh-ochre margin which in fully matured spots is dark red. Later, numerous erumpent, spherical or subspherical, black sclerotia appear on the surface (more prominently on the lower) and are easily brushed off. The lesions (especially those near the margin) coalesce into long streaks. The average size of the individual lesions is 5 by 1 cm., and it is not uncommon to find over half the total leaf area affected.

A coloured subepidermal stroma produces cylindrical, flexuose, 1- to 8-septate, conidia, which are borne at the truncate apex of the conidiophores, measure 56 to 106 by 2 to 3·3 μ but are generally 65 to 75 μ long, usually with one, but occasionally with up to three, lateral branches measuring 16 to 35 by 1·7 to 3 μ. After sporulation the subhymenial cells multiply, the hymenial portion of the stroma is pushed beyond the stomatal opening and produces dark, thick-walled cells which expand into a reniform or hemispherical sclerotium measuring 110 to 230 by 56 to 190 μ.

SIMPSON (D. M.). **The longevity of Cotton seed as affected by climate and seed treatments.**—*J. Amer. Soc. Agron.*, xxxviii, 1, pp. 32–45, 1 graph, 1946.

In the course of an investigation extending over a period of seven years on the influence of climatic factors and seed treatments on the longevity of Stoneville 2 cotton seed in various locations in the United States Cotton Belt, it was ascertained that fuzzy samples had a slightly lower moisture content than acid-diluted and averaged rather higher in germination. Seed treated with 2 per cent. ceresan germinated better than untreated, probably because of the control in the former of *Mucor* and other fungi. This fungicidal treatment was definitely not deleterious to stored cotton seed.

ARNDT (C. H.). **Effect of storage conditions on survival of Colletotrichum gossypii.**—*Phytopathology*, xxxvi, 1, pp. 24–29, 1 graph, 1946.

Portions of two lots of cotton seed (Deltapine 11a and Carolinadel No. 2) naturally infected by the anthracnose fungus, *Colletotrichum* [*Glomerella*] *gossypii*, were adjusted at the South Carolina Agricultural Experiment Station to moisture contents of roughly 8, 10, 12, 14, and 16 per cent., samples of each of which were placed in storage at 1°, 21°, and 33° C., as well as at the air temperature of Knoxville, Tennessee [*R.A.M.*, xxiv, p. 100]. After 12, 17, and 66 months under these conditions, seeds from the various samples were germinated at 24° to determine the extent of survival of the pathogen.

After 5½ years' storage at 1°, over 75 per cent. infection developed on the seedlings arising from seeds kept at 8 per cent. moisture content, while a lower number tended to contract the disease with each consecutive increase in the humidity of the seed up to 16 per cent., at which the incidence ranged from 19 to 27 per cent. In these experiments the fungus generally lost its infective capacity before the viability of the seeds was perceptibly impaired. At higher temperatures survival was greatly diminished.

Non-germinating seeds harboured principally *Fusarium moniliforme* [*Gibberella fujikuroi*], small percentages also being infected by *Aspergillus* spp., *Chaetomium* sp., *Ophiotrichum* sp., and (at 14 and 16 per cent. moisture contents) *Rhizopus* sp.

VOLK (N. J.). **Nutritional factors affecting Cotton rust.**—*J. Amer. Soc. Agron.*, xxxviii, 1, pp. 6–12, 5 figs., 1946.

Observations and tests from 1937 to 1943 in Alabama showed that the soil from field areas producing 'rusted' cotton contained about half as much potash as that from adjacent portions on which the crop was healthy [*R.A.M.*, xxiii, p. 225]. The disease did not appear to be associated with boron, copper, zinc, manganese, or magnesium deficiency, and was eliminated by the application of potash to the soil at dosages of 48 to 96 lb. per acre. Sodium nitrate alleviated the disorder but failed to control it in severe cases, while its incidence was increased by heavy applications of phosphorus. 'Rust' assumed an acute form on land from which several groundnut crops had been dug, reducing the exchangeable potash content to very low levels. Potash acted more effectively when applied before planting than as a side-dressing. The anti-'rust' treatment retarded the maturity of the crop to a degree permitting of substantial boll weevil [*Anthonomus grandis*] damage.

MARCHIONATTO (J. B.). **Nota sobre algunos hongos entomógenos.** [Note on some entomogenous fungi.]—*Publ. misc. Minist. Agric., B. Aires,* Ser. A, i, 8, 10 pp., 1 col. pl., 3 figs., 1945.

Some of the observations on entomogenous fungi in Argentina and other Latin American countries have already been noticed in this *Review* from other sources. Since 1934, when the author described the characteristics of *Beauveria globulifera* (*Rev. argent. Agron.*, xx, pp. 13–18, 1934), he has received specimens of the fungus on *Bombyx mori*, *Laspeyresia molesta*, *Diatraea saccharalis*, and *Listroderes* sp., the countries affected being Brazil, Argentina, and Uruguay. The fungus produced an abundant cottony mycelium and a pulverulent mass of cream-coloured spores on 1 per cent. dextrose agar, while on potato disks it secreted a yellow pigment which partially tinted the medium. *Beauveria bassiana* and *B. effusa* are closely related to the species under investigation, but the mycelium of the former is farinaceous and the latter secretes a reddish pigment [*R.A.M.*, v, p. 95].

Cephalosporium lecanii is widespread on both banks of the La Plata on various cochineal insects [ibid., xiv, p. 98], and of late years it has been determined on *Icerya purchasi* and *Pulvinaria flavescens*.

Cladosporium aphidis, supposed by some authors to be merely a strain of *C. herbarum* [ibid., iii, p. 52; xii, p. 216], commonly develops on the cottony areas colonized by the 'white fly' (*Aleurothriscus howardi*) on the under side of orange and other citrus leaves.

Empusa americana was observed for the first time in Argentina in 1933, parasitizing *Parexorista caridei* on the foliage of a member of the Gramineae, and specimens have recently been received of the same fungus attacking *Lucilia caesar* on a *Eucalyptus* branch.

Empusa aphidis assumes an epizootic character on the cabbage aphid (*B*[*revicoryne*] *brassicae*) in the province of Buenos Aires in rainy seasons, especially in the autumn, and in 1944 material of the same fungus on radish and cereal aphids was submitted from Coloma, Uruguay. The species in question is readily differentiable from *E. planchoniana* [ibid., xvii, p. 240] by its oval conidia, 19 to 21 by 11 to 13 μ, with their papillae situated in the narrow base, and from *E. fresenii* [ibid., xix, p. 213] by its truncate papillae.

Spicaria prasina [ibid., xxi, p. 452] was isolated on potato dextrose agar from the cotton caterpillar (*Alabama argillacea*) from Tucumán; its taxonomy is briefly discussed.

LOUNSKY (J.). **Het ontsmetten van tuinbouwplanten met hun wortelaardkluiten en meer in het bijzonder van de Azalea.** [The disinfection of horticultural plants with their root soil clods and more especially of the Azalea.]—*Parasitica,* i, 4, pp. 113–128, 6 pl., 1 graph, 1945.

Incidental reference is made in this paper, dealing largely with insects, to *Botrytis cinerea*, which is stated to be responsible for regular heavy losses among *Begonia*, *Gloxinia*, and *Rhododendron* seedlings in Belgian nurseries. Effective control has been achieved by soil disinfection with a 0·5 per mille solution of a commercial product consisting chiefly of mercury chlorophenol, which also proved useful in the campaign against *Pythium debaryanum*. Similar results were subsequently obtained with another proprietary preparation having salicylic acid (1 per mille) as the active ingredient.

VANDERWALLE (R.). **Une affection maculicole de Laurus nobilis causée par un champignon nouveau.** [A spotting disease of *Laurus nobilis* caused by a new fungus.]—*Parasitica,* i, 4, pp. 145–151, 2 pl., 1945.

Tetracytum lauri n.g., n. sp., is the name assigned [without a Latin diagnosis] to a fungus causing the development on the under sides of living *Laurus nobilis* leaves

in Belgian hothouses of confluent, brown spots with darker margins, which ultimately spread over a large part of the surface. At an advanced stage of infection, the upper side of the leaf assumes a leaden tinge. The subepidermal tissues of the lower surface contain paraplectenchymatous knots of mycelium.

The fungus is characterized on nutrient agar by reddish-brown colonies and hyaline, fasciculate, septate, sparsely branched conidiophores, 180 to 260 μ in height, bearing a triple sporophore, and terminal, hyaline, cylindrico-oblong, tri-, rarely non- or biseptate conidia, 52 to 75 (mean 62) by 5·2 to 6·5 μ. It is closely allied to *Cylindrocladium scoparium* [*R.A.M.*, xxiii, p. 305] in the Didymosporae, but the tetracellular conidia of the species under discussion definitely relegate it to the Hyalophragmiae and hence the erection of a new genus appears to be called for.

SEVERIN (H. H. P.). **Leaf variegations in perennial Delphiniums.**—*Hilgardia*, xiv, 10, pp. 573–582, 2 pl., 1 fig., 1942. [Received February, 1946.]

Investigations into two leaf variegations [*R.A.M.*, xvii, p. 402] in perennial *Delphinium*, for which the names 'golden leaf' and 'silver leaf' are proposed, suggest that these anomalies are not transmissible by juice or insect inoculations, that they are not virus diseases, but are seed-borne. The patterns of golden-leaf variegation resemble those of calico [ibid., xxii, p. 207] on second-year or older plants, but the two conditions are easily distinguishable because golden leaf affects all the leaves, whereas the symptoms of calico are confined to the basal and intermediate foliage. The most prominent and characteristic pattern of golden-leaf variegation is formed by large, yellow areas extending into the lobes of the leaves. Other patterns show yellow streaking, mottling, or a combination of both; or mostly large yellow-green and green areas, with normal flowers in all cases.

Greyish-white instead of golden areas on the lobes of the leaves are the distinguishing feature of silver-leaf variegation, accompanied on seedlings by numerous small, green dots, some leaves on the same plant showing almost albino lobes with chains of dots extending along the veins. Silver-leaf variegations are often found in seed-beds, but rarely on plants in the field.

BISSETT (J.). **The black spot or mosaic in Cymbidiums.**—*Aust. Orchid Rev.*, x, 3, p. 48, 1945.

The writer has found that the sole remedy against mosaic in *Cymbidium* spp. in New South Wales [cf. *R.A.M.*, xxiii, p. 261] is to burn diseased plants as soon as the white, yellow, or black flecks are observed in the new growth. The virus does not appear to be transferable from one plant to another, but develops among orchids potted in poor mixtures or grown under adverse conditions. The freedom of certain individuals from infection points to inherent variations in susceptibility to the disease.

ROSE (R. E.). **Germination and conidial number relationship in blind seed disease.**—*N.Z. J. Sci. Tech.*, A, xxvii, 3, pp. 255–257, 1945.

The following technique was evolved at the Department of Scientific and Industrial Research, Palmerston, New Zealand, for the rapid determination of rye grass (*Lolium perenne*) seed infected by the agent of blind-seed disease, *Phialea temulenta*, based on conidial number counts [*R.A.M.*, xxv, p. 168]. One hundred seeds per sample were placed in a test tube with 5 ml. water and heated in a water bath for 15 minutes at 80° C., after which the tubes were shaken for half a minute, a drop of the solution taken for a conidial count with a Zeiss Thoma haemacytometer, and the number covering the 16 large squares registered. Duplicate counts giving satisfactory agreement were made, and the averages are presented in two tables, representing the South and North Canterbury samples, respectively.

The correlation co-efficient for the former was —0·567 and for the latter —0·516, significant at the 5 and 1 per cent. levels, respectively. However, since the error of estimate of germination was 18·2 and 19·2 for the South and North Canterbury samples, respectively, the method can hardly be recommended for harvest-forecast purposes. Hyde's method of pre-harvest determination of germination percentages, based on the appearance of diseased seed [ibid., xviii, p. 186], is stated to give estimates of a very high degree of accuracy.

LEACH (J. G.), LOWTHER (C. V.), & RYAN (MARY A.). **Stripe smut (Ustilago striaeformis), in relation to Bluegrass improvement.**—*Phytopathology*, xxxvi, 1, pp. 57–72, 5 figs., 1946.

Ustilago striiformis from bluegrass (*Poa pratensis*) [*R.A.M.*, xxiii, p. 390] is readily cultivable on artificial media. Chlamydospores are formed in profusion on agar, and though sometimes rather abnormally large and irregularly shaped (oblong or lemon-shaped with pointed ends), they germinate in the ordinary way, producing cultures identical with those arising from the same organs from the host. Germination is effected by the formation of one or more branched germ-tubes that develop into a mycelium on nutrient agar. Two types of colonies occur, one typically mycelial and the other breaking up into sporidia-like fragments. Chlamydospores may be produced by either type, but certain cultures of both remain sterile.

Standard methods of seed inoculation resulted in rather low infection percentages, but a relatively high incidence of smut was obtained by soil inoculation and the injection of chlamydospores with a hypodermic needle into the stem near the growing point. Evidence was obtained that the smut may persist in the soil in the greenhouse up to 256 days. Infection from the soil is not confined to very young seedlings but may occur readily on older plants, probably through young tillers. The feasibility of inoculating vegetatively propagated clones of *P. pratensis* has been demonstrated. If, as there is reason to believe, the present lengthy incubation period can be curtailed, this would appear to be a promising method of eliminating susceptible material and selecting resistant clones in connexion with the programme of breeding for pasture improvement.

WOLLENWEBER (H. W.) & HOCHAPFEL (H.). **Beiträge zur Kenntnis parasitärer und saprophytischer Pilze. V, 3. Diplodia und ihre Beziehung zur Fruchtfäule.** [Contributions to the knowledge of parasitic and saprophytic fungi. V, 3. *Diplodia* and its relation to fruit rot.]—*Zbl. Bakt.*, Abt. 2, cvi, 20–24, pp. 443–464, 4 figs., 1944.

Continuing their studies on *Diplodia* spp. as agents of fruit rot [*R.A.M.*, xxiii, p. 361], the writers carried out inoculation experiments with *D. gallae* (Schw.) Cke (syn. *Sphaeropsis gallae* (Schw.) Archer) from oak (*Quercus rubra*) leaf galls from Michigan, United States; *D. hypodermia* (Sacc.) Wr n. comb. (*S. hypodermia* (Sacc.) Höhn.) from elm (*Ulmus scabra*) branch wood from Fredriksstad, Norway; *D. visci* (DC.) Fr. from mistletoe (*Viscum album*) leaves and branches from Uckermark, Germany; and *D. brunnea* (Bon.) Wr n. comb. (*S. brunnea* (Bon.) Sacc.) from dead beech branches (Germany), and dead sugar maple (*Acer saccharum*) and American sumach (*Rhus glabra*) from Michigan.

D. visci was innocuous to apples and quinces, both of which, however, were fairly vigorously attacked by *D. gallae* and completely rotted within a month. *D. hypodermia* and *D. brunnea* caused a much slower and weaker infection, the decayed areas reaching only 2 to 5 cm. in diameter at the end of the fourth week.

A key is appended for the determination of the 13 species and one variety under investigation (in this and the previous papers), together with a table showing the

extent of the damage caused by each on quinces and apples after 7, 14, and 28 days.

LOUW (A. J.). **Peach mildew.**—*Fmg S. Afr.*, xxi, 239, pp. 93–99, 1 fig., 1 graph, 1946.

Peach mildew (*Oidium leucoconium*) [*Sphaerotheca pannosa* var. *persicae*: *R.A.M.*, xviii, p. 463; xxiv, p. 107] first reached epidemic proportions in the western Cape Province in 1941–2, and has now become general throughout the winter-rainfall area. It causes drying-out and shedding of the leaves, twig die-back, and hard, white patches, which may develop into cracks, on the fruit. Even slight infection is undesirable on dessert varieties; and while, for canning purposes, a certain degree of infection is tolerated, some fruit has been refused.

No commercial variety appears to be immune, and Tuscan Cling, Kakamas, and the so-called 'Vark' peach (sometimes used as a rootstock) are particularly susceptible. All nectarines and the white-fleshed peach varieties, Pucelle de Malines, Duke of York, and Inkoos are severely attacked, while Peregrine and Early Dawn are rather less susceptible. Elberta appeared to be least affected.

The first infections occur chiefly on the fruit, the inoculum originating from the diseased dormant twigs and buds of the previous season. Leaf and shoot infections occur much later. Conditions of high humidity accompanied by high temperature favour infection, while the presence of free moisture, as during rain or fog, retards it. Warm, sultry weather is particularly conducive to the disease. Mildew generally appears towards the end of October, and is most severe in December and January. It is worse in the warm interior regions than in coastal areas. Irrigated orchards and those on poorly drained soils are more frequently attacked.

Besides spraying [loc. cit.] removal of infected twigs during winter pruning and improved drainage are recommended. When the trees have become badly affected, the control measures suggested must be carried out for several years before complete recovery can be expected.

CIFERRI (R.). **Ulteriori esperienze ed osservazioni sulla 'rosetta' del Pesco nell' Albese.** [Further experiments and observations on Peach 'rosette' in the vicinity of Alba.]—*Boll. Staz. Pat. veg. Roma*, N.S., xxi, pp. 133–156, 1941. [Received February, 1946.]

Further investigations into nutritional rosette of peach trees at Alba, Italy [*R.A.M.*, xiii, pp. 384, 408], demonstrated that the condition is not epidemic. It never showed any tendency to spread, but affected only scattered trees in certain plantings. Only peach trees planted in areas where timber had been felled and uprooted were attacked. The disease gradually became less marked, and after a few years disappeared. If there was an interval of some years between the felling of the timber and the planting of the peaches, the disease did not appear. Cultivation, viz., digging and incorporating organic matter in the soil, effected a temporary improvement, the effect probably resulting from improved soil aeration. The application to diseased peaches of solutions of copper, manganese, boron, and zinc salts had no effect on the condition. The water percolating through the soil in which the affected peaches were growing appeared to be toxic to wheat seedlings, but the toxicity was reduced when the water was exposed to the air, or when an oxidizing agent (oxygenated water or potassium permanganate) was added to it. The toxic principle present in the water was found to have various constituents, most of them thermostable at 100° C. but readily destroyed by oxidation. In nature, inactivation by oxidation appears to be due to the activities of soil micro-organisms.

The evidence taken as a whole indicates that the condition is physiological in nature, and due to toxins present in the soil.

Willison (R. S.) & Berkeley (G. H.). **Tatter leaf of Sweet Cherry.**—*Phytopathology*, xxxvi, 1, pp. 73–84, 2 figs., 1946.

Tatter leaf of sweet cherries has been observed in several orchards in the Niagara Peninsula, Ontario [*R.A.M.*, xxiv, p. 235] since it was first detected on the Black Tartarian variety in 1940, and one strain of the virus responsible for the disease has been transmitted by the double budding technique [ibid., xxiv, p. 197] or by direct grafting of nursery stock or orchard trees to a number of plum, peach, and sweet and sour cherry varieties.

An indistinct mottle of the early leaves was the only symptom to develop in inoculated plums of the Italian prune, Lombard, and Reine Claude varieties.

On Rochester and Elberta peaches the acute symptoms, comprising slight superficial bark necrosis, and foliar ring patterns and chlorotic markings, appear at the opening of the first growing season after inoculation. These are later (usually in the second year) replaced by the chronic features of the disease, including faint mosaic and oak-leaf patterns, dullness and premature ageing of the upper leaf surface, fine red pin-spotting, and red-rimmed, fawn necrosis which may be found on leaves scattered over the tree. Symptoms of the chronic type further displace the acute ones on seedlings inoculated in the late summer and cut back to the bud in the following spring.

In the spring after inoculation, Black Tartarian cherries develop fine, brown lines circumscribing the interveinal areas, which soon undergo necrosis and fall out. Faint yellowish mottling and oak-leaf patterns also occur. Symptom expression appears to be confined to foliage emerging early in the growing season and to diminish in intensity the later the infection. Napoleon is less, and Bing more, affected by necrosis and laceration than Black Tartarian.

Fine, etched rings and necrotic spotting are characteristic of the acute, and undulations, rugosity, and torsion of the leaf blades of the chronic phase of tatter leaf on Montmorency. The acute symptoms on this cherry resemble those of necrotic ring spot and some strains of prune dwarf [loc. cit.], but the interrelationships, if any, of the viruses concerned are still conjectural.

Suit (R. F.). **Currant leaf spot control.**—*Bull. N.Y. St. agric. Exp. Sta.* 709, 13 pp., 2 figs., 1945.

Leaf spot, the most widespread disease of currants [*R.A.M.*, xxv, p. 2] in New York State, is caused as to 85 per cent. by the anthracnose fungus, *Pseudopeziza ribis*, and as to 15 per cent. by *Mycosphaerella grossulariae*. The disease causes premature loss of leaves, resulting in lower yields, shorter life of the plant, and increased disposition to winter injury.

Control measures by spraying vary in their recommendations from two to five applications, the last being usually given after harvesting of the crop, and include concentrations of Bordeaux mixture from 10–10– to 4–6–100, no adhesive agent being advocated in any of the treatments advised. In New York State two sprayings have been considered adequate and timing is the determining factor in their efficacy. About three weeks after blossoming seems the most suitable date for the first application, but it is advisable to observe the bushes from about 15th May when, if the lower or central leaves of a bush show spotting, the first spraying should be given forthwith, the second following immediately after picking of the fruit.

The leaf-spot pathogens overwinter in dead infected leaves on the ground and reach maturity about mid-May with the production of ascospores which attack the leaves in rainy weather. For this reason, the timing of the first spraying is crucially important. Once the spots have appeared on the leaves, conidial production follows and the disease spreads to other leaves as the summer goes on.

It was found that the most satisfactory concentration of Bordeaux mixture was 3-3-100, provided that both surfaces of the leaf were thoroughly treated and the best spreader-sticker employed as well, thus giving increased control. Insoluble copper treatments, which left no objectionable spray residue, were effective providing that their copper content was equal to that of the 3-3-100 Bordeaux and 1 pint of S.E.C. oil added [ibid., xxiv, p. 321] as an adhesive. Spraysoy A and rosin fish-oil soap were satisfactory adhesives when used with Bordeaux mixture but not so effective as S.E.C. oil. Formate, U.S.R. 604, wettable spergon, and lime-sulphur were ineffective.

GADDINI (L.) & CIFERRI (R.). **Il Banano nell Oasi di Derna.** [The Banana in the Derna Oasis.]—*Relaz. Monogr. agr.-colon.* 59, 34 pp., 16 figs., 1 map, 1940. [Received February, 1946.]

On pp. 28–32 of this publication the authors give an account of bacterial rot (*Bacterium* [*Xanthomonas*] *solanacearum*) of the local banana variety (*Musa paradisiaca sapientum*) [*M. sapientum*] and the Alexandrian banana (*M. nana*) [? *M. cavendishii*] grown commercially at Derna, Libya, summarized from their earlier paper on the subject [*R.A.M.*, xix, p. 158]. *Gloeosporium musarum* occurred on ripe bananas in the Derna market.

DAS GUPTA (S. N.) & ZACHARIAH (Miss A. T.). **Studies in the diseases of Mangifera indica. Part V. On the die-back disease of the Mango tree.**—*J. Indian bot. Soc.*, xxiv, 3, pp. 101–108, 13 figs., 1 pl., 1945.

Continuing their studies, the authors have investigated the relative pathogenicity or otherwise of *Botryodiplodia theobromae* [*R.A.M.*, xix, p. 355], *Phoma* sp. [ibid., xvi, p. 588], and *Fusarium* (two isolates) [ibid., vii, p. 20] in regard to the die-back disease of mango. The characteristic general symptoms are wilting of the branches and twigs, particularly of the maturer trees, causing later complete defoliation and giving the tree a scorched appearance. Discoloration and darkening of the bark some distance from the tip is the primary external evidence of the onset of 'die-back' and, as this dark area advances, withering of the young green twigs begins, starting at the base, then affecting the midrib, and extending outwards along the veins to the leaf edges. Finally the whole leaf goes brown, accompanied by an upward roll of the margin, and the twig or branch dies, shrivels, and falls after about a month. Gum also may be extruded.

An internal discoloration of the infected twig is earlier discernible about 1 in. on either side in extent towards the tip and base beyond the outer browned bark; and a brown streaking of the vascular tissues is observed on slitting slantwise along the long axis. Epidermal and subepidermal cells of twigs outwardly healthy, apart from small discoloured areas on the stem, were seen at a quite early stage to be slightly shrivelled, areas of the cambium and phloem acquired a brown discoloration, and some of the cells there were observed to be closely filled with a yellow gum-like exudate. Some hyphae were noted in the xylem vessels. The inner cortical areas seemed normal, although cells in the outer layers had begun to shrivel. The final stages of the disease were characterized by extensive shrivelling of the stem tissues, obstruction of the xylem vessels with fungal mycelium, and disjunction of the stele and outer layers along the discoloured streak of disintegrated cambial cells, where there were many hyphae. Mycelium was also present in the petioles and midribs of leaves of diseased twigs.

The results of isolations from diseased twigs and inoculation experiments on healthy growing twigs showed *B. theobromae* to be the causal agent of die-back disease. From some naturally infected twigs only the *Phoma* could be isolated, but its status as a pathogen was not established; there was nothing to suggest that *Fusarium* was pathogenic. None of the fungi was able to attack healthy trees.

High summer temperature is thought to be a possible factor contributing to impaired vitality of the tree, predisposing it to fungal attack [cf. ibid., xvi, p. 670].

THIRUMALACHAR (M. J.). **An Ascomycetous parasite of Cephaleuros.**—*Proc. Indian Acad. Sci.*, Sect. B, xxii, 6, pp. 374–377, 4 figs., 1945.

Cephaleuros parasiticus and *C. mycoidea* [*R.A.M.*, xxi, p. 392] have been collected on numerous hosts in Mysore, where the former in particular is responsible for blemishes on guava fruits. In most of the material examined the algal patches had apparently been destroyed and their red pigment obliterated by a fungus presenting the characters of a species of *Strigula* E. Fr. 1821, closely resembling *S. astridiza* Vain., including minute, black, semi-globose, prominent perithecia and clavate-cylindrical, paraphysate asci each containing eight long, fusiform, quadriseptate, hyaline spores. Zahlbrückner, in the section on ascolichens in Engler & Prantl's 'Die natürlichen Pflanzenfamilien', viii, pp. 67–270, 1926, refers the genus under discussion to the Verrucariaceae and describes it as resulting from the association of algae with an Ascomycete. The nature of the relationship between the algal and fungal components of lichens has been the subject of much controversy: the present instance appears to lend support to E. J. Butler's opinion (Fungi and disease in plants, pp. 413–422, 1918) that the death of the *Cephaleuros* on tea is accelerated by the invasion of fungal hyphae. The crustose, lichen-like appearance is due to cementing together of the dead algal filaments by the gelatinous mycelium.

CIFERRI (R.), BALDACCI (E.), BARBENSI (G.), CAVALLI (L.), & GALLINA (G.). **Primi dati della tecnica di controllo del potere anticrittogamico in vitro.** [First data on the technique of estimating fungicidal power *in vitro*.]—Reprinted from *Chimica*, xx, 1–2, 5 pp., 1 fig., 1944. [Received April, 1946.]

In this paper the authors give a brief account of investigations at Pavia into various methods of estimating the fungicidal properties of spray mixtures. The full report on the work in question has already been noticed from another source [*R.A.M.*, xxv, p. 223].

Les produits antiparasitaires destinés a l'agriculture, l'arboriculture, la viticulture et l'horticulture (Pflanzenschutzmittel zur Bekämpfung von Krankheiten und Schädlingen im Feld-, Obst-, Wein- und Gartenbau).—[Plant protectives for the control of diseases in agricultural, sylvicultural, viticultural, and horticultural crops.]—29 pp., Station de Recherches de Wadenswil et Zürich-Oerlikon, 5° éd., 1944. [Abs. in *Ann. agron.*, *Paris*, N.S., xv, 1, p. 143, 1945.]

This brochure, published every February, is intended as a guide to growers in the choice and use of fungicides and insecticides. The introduction gives the decisions on the control of Swiss phytopharmaceutical products in 1944, following the decree of 12th September, 1941, which brought the sale of fungicides and insecticides under State supervision. These products cannot be manufactured and sold in Switzerland until they have been tested and approved by the Federal experiment stations. The first part lists the products arranged according to the parasites, with notes on the dosages and times of application. In the second part, 307 special products approved during 1944 are catalogued according to the technique of their application and their chemical composition.

BREMER (H.) & ÖZKAN (H.). **The effect of fungicides and insecticides on plants.**—*Zir. Derg.*, vi, 69, pp. 7–23, 1945. [Turkish, with English summary.]

In Turkey Bordeaux mixture is seldom injurious to plants in the predominantly dry climate, damage from this source having been observed by the writers only after the first spring treatments of vines against *Plasmopara viticola* in the coastal regions. In central Anatolia, fruit trees have been sprayed with the mixture at

concentrations of up to 8 per cent. without ill effects in the summer months. Copper sulphate is still widely used for the disinfection of wheat seed-grain against bunt (*Tilletia foetens* [*T. foetida*] and *T. tritici* [*T. caries*]) [*R.A.M.*, xxiv, p. 496].

PARKER (E. R.), MIDDLETON (J. T.), & VANSELOW (A. P.). **Neutralizing materials for copper sprays.**—*Calif. Citrogr.*, xxxi, 2, pp. 56–60, 1945.

The authors' experiments with various precipitants designed to minimize the damage to plant foliage caused by the presence of soluble copper in spray material showed that copper preparations amended with hydrated lime usually reduced the amount of soluble copper to very low values, particularly with copper sulphate where low copper solubility comparable to that of insoluble copper preparations was obtained. 'Dilute' soda ash did little to lower copper solubility in the filtrate except in association with copper sulphate, when almost all the copper was precipitated, but not so completely as when hydrated lime was used. 'Concentrated' soda ash, however, increased copper solubility in most spray suspensions. The increase over the value obtained with dilute soda was most marked when copper sulphate was used. The addition of small quantities of lime to concentrated soda ash caused a reduction in the soluble copper.

With three concentrations of copper sulphate, the least water-soluble copper occurred when the weight of soda ash in the mixture was two-thirds that of the copper sulphate and with low copper concentration. Zinc sulphate reduced the soluble copper in copper sulphate-soda ash mixtures. Tecmangam, a magnesium sulphate preparation, when added either alone or with zinc sulphate to the copper sulphate-soda ash mixture increased copper solubility, particularly at the higher concentrations of copper sulphate and tecmangam. The possible relationship of the ammonium sulphate content of tecmangam to copper solubility was not investigated. The order of mixing the various ingredients was found to have no appreciable effect on the copper solubility.

WENE (G.) & RAWLINS (W. A.). **Compatibility of cryolite and copper fungicides.**—*J. econ. Ent.*, xxxviii, 6, pp. 655–657, 1945.

The combination of the commercial fixed copper compounds, yellow cuprocide, C O C S, spraycop, and basicop with natural cryolite (kryocide) did not reduce the toxicity of the latter to third- and fourth- instar Mexican bean beetle (*Epilachna varivestis*) larvae in spraying tests on beans [*Phaseolus vulgaris*] at the Cornell Agricultural Experiment Station, Ithaca, New York. Bordeaux mixture delayed and decreased the insecticidal action of cryolite, but did not altogether counteract it. In a single field experiment on potatoes for the control of the Colorado beetle (*Leptinotarsa decemlineata*) Bordeaux also retarded the action of cryolite, but did not materially reduce final mortality in comparison with the percentage obtained in two fixed-copper combinations (yellow cuprocide and Tennessee tribasic).

YARWOOD (C. E.). **Detached leaf culture.**—*Bot. Rev.*, xii, 1, pp. 1–56, 1946.

With numerous references to the relevant literature the present state of knowledge concerning detached leaf culture, i.e., maintaining leaves in a living condition for various periods after detachment from the plant, is reviewed and discussed. The main points covered include the physiology of detached leaves and the effect of detachment on normal life processes, mechanics of culture, conditions affecting the lives of detached leaves, and the uses and advantages of detached leaves.

Detached leaves have served as a convenient substratum for the total culture (from spore to spore) of members of the Peronosporaceae, Erysiphaceae, Uredinales, Sphaeropsidales, Melanconiales, and Moniliales. Among the more important features of the rusts and powdery mildews studied in this way are carbohydrate nutrition, environmental effect on disease, host range, physiologic specialization, heterothallism, formation of overwintering stages, respiration, and

effect of volatile fungicides. The advantages of the method include economy of space, material, and inoculum, ease of controlled experimentation, and the luxuriant growth of some parasitic fungi. The method has, however, its limitations, e.g., onion leaves die too quickly for the culture of almost any pathogen except *Peronospora destructor*; *Uncinula necator* grows poorly on detached grape leaves; and in fungicide tests detached leaves showed no advantage over entire plants.

A bibliography of 332 titles is appended.

Smith (G.). **An introduction to industrial mycology.**—Third edition.—xiv+271 pp., 143 figs., London, Edward Arnold & Co., Ltd., 1946. 20s. net.

The third edition of this text-book [*R.A.M.*, xxii, p. 74] contains a number of minor alterations and additions designed to increase its clarity and usefulness.

Lindegren (C. C.). **Breeding yeasts for their new role in nutrition.**—*Bull. Mo. bot. Gdn*, xxxiv, 2, pp. 37–43, 5 figs., 1946.

After briefly discussing yeasts in ancient times, pure-culture technique and pasteurization, yeasts of modern times, vitamins and amino-acids in yeasts, selection and hybridization, inheritance, sex, and new hybrids, the author describes a new method of producing yeast hybrids, in which individual spores from a sac are dissected out and grown separately. A culture of *S[accharomyces] cerevisiae* was obtained with a single set of chromosomes. This species was unable to synthesize pantothenic acid and biotin [vitamin H], but was able to synthesize pyridoxin. From *S. carlsbergensis* a culture of the opposite sex was obtained which was unable to synthesize pyridoxin, though it synthesized pantothenic acid and vitamin H. The hybrid made by mixing these two cultures was able to synthesize pyridoxin, pantothenic acid, and vitamin H.

Kurth (E. F.). **Yeasts from wood sugar stillage.**—*Industr. Engng Chem.*, xxxviii, 2, pp. 204–207, 1946.

Three yeast strains, *Torula* [*Torulopsis*] *utilis* No. 3, *Mycotorula lipolytica* (P-13), and *Hansenula suaveolens* Y-838, were grown on still waste liquor from the production of Douglas fir [*Pseudotsuga taxifolia*] wood sugar alcohol [*R.A.M.*, xxiv, p. 283] at Springfield, Oregon. All three were found to utilize a large proportion of the unfermentable sugars and acids in the liquor, suggesting their potential use in the large-scale conversion of liquors of this type. The yield of dry *T. utilis* may exceed 50 per cent. of the weight of the sugar consumed, indicating the assimilation by the yeast of components other than sugars for its growth. Air diffusion was shown to be an important factor in the rate of yeast development and sugar consumption. With proper aeration by means of gas dispersion tubes of coarse-porosity fritted glass, the time required for these processes was reduced from 72 hours in shaker flasks and 36 to 48 in 4-mm. glass tubing to approximately 18 hours.

Carr (L. G.). **Action of supernatants from combined growth of Fusarium solani and Pseudomonas aeruginosa against the tubercle bacillus.**—*Nav. med. Bull., Wash.*, xlvi, 2, pp. 237–238, 1946.

Fusarium solani was grown for four weeks in a shallow layer on a 1 per cent. hydrolysate of casein, to which was then added a suspension of *Pseudomonas aeruginosa*; the two organisms were allowed to grow together for a fortnight, when the supernatant from the combined cultures was ready for testing against the tubercle bacillus (*Mycobacterium tuberculosis*). The centrifuged supernatant was mixed with an equal volume of a suspension of the bacillus (H 37) (5 mg. per c.c.) and the resulting preparation incubated for 12 hours at 37·5° C., placed for 36 hours in the refrigerator, and treated with 3 per cent. sodium hydroxide for 30 minutes

at 37·5°. In six experiments the growth of the bacillus was entirely suppressed for periods of three weeks to a month and was very slight thereafter. No toxic effects were induced in mice by the injection of 1 c.c. of the crude material; further experiments with the active principle in a purified form are planned.

ARNSTEIN (H. R. V.), COOK (A. H.), & LACEY (M[ARGARET] S.). **An anti-bacterial pigment from Fusarium javanicum.**—*Nature, Lond.*, clvii, 3985, pp. 333–334, 1946.

'Javanicin' is the name proposed by the authors for a new antibiotic pigment, derived from strains of *Fusarium javanicum* [*R.A.M.*, xxii, p. 13], several of which were seen to inactivate the acid-fast *Mycobacterium phlei*. Javanicin was found to inhibit the growth of *Staphylococcus aureus* and *M. phlei* at a dilution of 1 : 400,000; and Dr. W. H. Tytler reports that the human-type tubercle bacillus was almost completely and apparently permanently inhibited at 1 : 50,000 – 1 : 100,000.

BRIAN (P. W.) & MCGOWAN (J. C.). **Biologically active metabolic products of the mould Metarrhizium glutinosum S. Pope.**—*Nature, Lond.*, clvii, 3985, p. 334, 1946.

The authors describe the isolation from *Metarrhizium glutinosum* [*R.A.M.*, xxii, p. 328], known as an active decomposer of cellulose [ibid., xxii, p. 73], of a fungistatic substance, to which they propose to give the name 'glutinosin'. Somewhat specific in its antifungal action, glutinosin is not markedly antibacterial. Its aqueous solutions are stable and fungistatic activity endures for 10 days at 25° at P_H range of 2·9 to 7·6, loss of activity being indicated at P_H 8·4. It shares the status of viridin [ibid., xxiv, p. 427] as a specifically antifungal antibiotic, but has much greater stability. The minimum concentration (μgm. per ml.) of glutinosin required to prevent spore germination was as follows: *Botrytis allii* 0·2, *Penicillium expansum* 25, *P. digitatum* 1, *Fusarium caeruleum* 0·8, and *F. graminearum* [*Gibberella zeae*] 50. Glutinosin has no irritant properties but a substance extracted with glutinosin was responsible for a dermatitis developed by those handling large-scale cultures of the fungus.

HOGEBOOM (G. H.) & CRAIG (L. C.). **Identification by distribution studies, VI. Isolation of antibiotic principles from Aspergillus ustus.**—*J. biol. Chem.*, clxii, 2, pp. 363–368, 2 graphs, 1946.

Kurung has recently reported the production by *Aspergillus ustus* [*R.A.M.*, x, p. 392] of a substance inhibiting the growth *in vitro* of *Mycobacterium tuberculosis* and *M. ranae* (*Science*, N.S., cii, p. 11, 1945). At the Rockefeller Institute for Medical Research, New York, the writers isolated from a crude extract of the mould two crystalline antibiotics and a third partially crystalline active fraction, using the 'counter-current distribution' technique (*J. biol. Chem.*, clv, p. 519, 1944; clxi, p. 321, 1945).

KRASILNIKOV (N. A.) & KORENYAKO (A. I.). Антибактериальные свойства грибка **Aspergillus niger.** [Antibiotic properties of the fungus *Aspergillus niger*.]—Микробиология [*Microbiology*], xiv, 5, pp. 347–352, 1945. [English summary.]

Three out of eight strains of *Aspergillus niger* [*R.A.M.*, xxii, p. 13] were experimentally shown to produce an antibiotic active against Gram-positive and Gram-negative bacteria. It is named aspergillin. Its antibacterial activity was little or not at all affected by the presence of pus or blood serum and proved much more active than mycetin. Aspergillin resembles penicillin in its bactericidal properties but is distinguished from the latter by its inhibition of growth of Gram-negative bacteria and by its greater stability. It is said to be non-toxic for animals.

McComb (A. L.) & Griffith (J. E.). **Growth stimulation and phosphorus absorption of mycorrhizal and non-mycorrhizal northern White Pine and Douglas Fir seedlings in relation to fertilizer treatment.**—*Plant Physiol.*, xxi, 1, pp. 11–17, 4 figs., 1946.

In studies at the Iowa State Forest Nursery two-year-old seedlings of northern white pine (*Pinus strobus*) and Douglas fir (*Pseudotsuga taxifolia*) were planted on two adjacent beds on O'Neill sandy loam soil which had never grown conifers before and was known not to contain active mycorrhizal fungi, one bed being treated at the rate of 1 bush. per 400 sq. ft. with coniferous duff and active mycorrhizal-formative humus. Each bed was divided into three replicates for each species and individual randomized plots were treated with one of six phosphorus or phosphorus, nitrogen, and potassium combinations.

Mycorrhizal development was observed to occur in association with white pine seedlings planted on uninoculated soil fertilized with phosphorus and the trees grew well. The growth of Douglas fir seedlings, which did not form mycorrhizal associations and reacted moderately to phosphorus fertilization, was not normal. Apart from one Douglas fir, healthy growth was always associated with vigorous assimilation of phosphorus. The facts that Douglas fir showed more retarded growth on uninoculated, fertilized plots than on inoculated plots, despite high phosphorus levels in these plots, and that no response was secured by using nitrogen and potassium, suggest the presence of a mycorrhizal stimulus quite apart from that directly due to phosphorus and attributable to an accelerated metabolism, stimulated in this case by phosphorus absorption and the promotion of growth by fungal influence upon the seedling, confirming the senior author's work [*R.A.M.*, xxiii, p. 238], and that of MacDougal and Dufrénoy [ibid., xxiv, p. 29].

Garner (J. M.) & Gottlieb (D.). **Obligate parasitism.**—*Nature, Lond.*, clvii, 3986, p. 374, 1946.

Radio-phosphorus, P^{32}, which is not changed by the host plant, was found at the Delaware Agricultural Experiment Station to afford a simple means of showing that nutrients from the soil were furnished to *Puccinia graminis* through the host plant, a fact that has not hitherto been demonstrated. Little Club wheat seedlings were divided into two lots, of which one was placed in Hoagland's solution and others in a similar solution containing radio-active potassium dihydrogen phosphate in place of the normal form. The plants were inoculated with spores of *P. graminis* race 56, incubated in a moist chamber for 36 hours, and grown under illumination of a 200-watt Mazda lamp at $20° \pm 2°$ C. Twelve days later analyses of the substratum and of dried samples of the leaves and spores revealed the following amounts of radio-phosphorus in the experimental material: solution (in counts of radio-activity per ml.), 5,900, uninoculated and inoculated leaves and spores (per gm. dry weight), 20,400, 21,067, and 13,200, respectively. On the other hand, radio-activity was absent from the controls grown in Hoagland's solution and from the substratum itself. Radiographs also revealed the presence of P^{32} in the leaves and spores on plants grown in the radio-active solution. It is apparent from these data that the plant absorbs the phosphate ions from the solution, distributing them among the leaves and other organs, whence they are assimilated by the hyphae and ultimately pass to the spores.

Turrell (F. M.). **Effect of sulphur gases in industrial smoke on vegetation.**—*Calif. Citrogr.*, xxxi, 2, pp. 40–41, 1 fig., 1945.

The prospect of further industrial development in California leads the author to examine the effect of sulphur dioxide [*R.A.M.*, xxiii, p. 69], chlorine, ammonia, and hydrogen sulphide gases [ibid., xvi, p. 110] from smoke likely to be absorbed by citrus leaves. Sulphur dioxide (the most toxic gas in large concentrations of

smoke) in combination with water on the wet cell walls, gives firstly the sulphite ion which, oxidized to sulphate ion, passes across the cells to the veins and is excreted by the roots. These reactions, if built up in dangerous concentrations through too rapid absorption by the plant, cause stiffening and swelling of the leaf, loss of water into the intracellular spaces, giving a water-soaked appearance to the leaf which wilts and curls, and chloroplastic collapse, the areas surrounded by veins becoming white, brown, or red, the two latter colours being caused by tannin oxidation. Where the cells in these vein areas are not separated, little gas is absorbed. Otherwise, rapid gas absorption by exposed surfaces causes white or brown spotting of the leaf, the cause of such injury being undeterminable except by chemical or spectroscopic analysis. The internal gas-absorbing surface of the thick-leafed lemon being 22 times that of the outside surface, and 11 times in the case of the vine leaf, which is half as thick as the lemon leaf and frail of structure, lemons will probably suffer more injury from industrial waste smoke gas absorption without showing it. Soil changes, as observed elsewhere, are considered likely to follow further industrialization and to require some modification of plant disease-control practice.

FERNANDEZ VALIELA (M. V.). **Principales virus que afectan a la Papa cultivada (con especial referencia a Gran Bretaña). Concepto, enfermedades y mantenimiento de semilla libre de virus ('nucleo stocks').** [Principal viruses that affect the cultivated Potato (with special reference to Great Britain). The concept, diseases, and maintenance of virus-free seed ('nucleo stocks').]—Federación Universitaria de Buenos Aires, Centro Estudiantes de Agronomia, 112 pp., 5 pl., 1 graph, 1946.

This monograph on potato viruses, in general and in particular, the maintenance of virus-free seed stocks, and seed certification, is stated in the author's foreword to be based almost exclusively on information acquired during a stay at the Plant Virus Research Station, Cambridge, in the course of which numerous centres of investigation were visited. A bibliography of 122 titles is appended.

BOTJES (J. O.). **De toepassing van een beschuttende enting als middel ter bestrijding van virusziekten bij de Aardappelplant.** [The application of a protective grafting as a means of Potato virus disease control.]—*Tijdschr. PlZiekt.*, xlvi, 6, pp. 181–193, 1940. [German summary. Received February, 1946.]

Köhler's theory regarding the character of potato top necrosis (acronecrosis) [potato virus X] and the development of acquired tolerance through protective grafting [*R.A.M.*, xvi, p. 707] is reviewed in the light of the writer's experiments in Holland from 1929 to 1939 [ibid., xiii, p. 179; xvi, p. 552; xviii, p. 411]. It is concluded that although the possibility exists of the development of complex diseases after protective inoculation, the risk does not appear to be of sufficient magnitude to preclude continuance of further trials in the utilization of attenuated strains of virus for protective purposes.

COÏC (Y.). **Contribution à l'étude de l'action du virus de l'enroulement sur la physiologie générale de la Pomme de terre.** [A contribution to the study of the action of leaf roll virus on the general physiology of the Potato.]—*Ann. agron., Paris*, N.S., xv, 1, pp. 86–109, 1945.

A reduction of 50 per cent. in the yield of the potato Bintje (due to a diminution of the number of tubers rather than size) led to a detailed study of the effect of the leaf roll virus on the general physiology of the Bintje potato. The data obtained indicated that the reduction of growth caused by the virus is due to non-utilization of the reserves in the affected 'seed' tuber. This results from a reduced utilization by the meristems of reserves which have been rendered soluble for active growth.

In contrast to the results of Schweizer [*R.A.M.*, x, p. 332], the nitrogen content of the dry matter in affected tubers remained more or less constant during the development of the young plant.

Inhibition of growth partly explains the physiological disturbance in the vegetative part. As the substances formed in the leaf are not utilized to form new tissues, they may be a cause of the enlarged growth of the leaves already formed and the accumulation in them of carbohydrates. It is, perhaps, in this direction that the effect on the physiology of the vegetative part of certain materials added to the plant (tannins, traces of copper sulphate) or to the soil (chlorates), which produce symptoms resembling those of leaf roll, should be sought.

Attention is drawn to the fact that the symptoms produced by the leaf roll virus were always the same whatever the plant or variety tested.

The evidence showed that starch accumulation in the leaf takes place before any outward symptom of leaf roll appears, and that it is not correlated with leaf-rolling or -hardening. It seems that the accumulation of carbohydrate is partly due to a higher photosynthetic activity in affected plants. This reaction is the opposite of that found in plants attacked by the virus complex, 'frisolée' [ibid., xiv, p. 246], in which the leaves have less dry matter and a lower level of carbohydrates than the corresponding healthy leaves, indicating a considerable diminution of photosynthesis. 'Frisolée' thus produces an even greater reduction in yield than does leaf roll.

As a result of a more abundant photosynthetic production of carbohydrates and the failure to use elaborated materials for growth or storage, the leaves of leaf roll plants become increased in area and thickness with an accumulation of carbohydrates and a reduction in the water content.

Leaf roll plants react to fertilizers (in particular nitrogenous ones), the physiological disturbances being reduced and the external symptoms rendered less apparent.

The biochemical constitution of the dug tubers shows a distinct increase, under the influence of leaf roll, in the ratio $\frac{\text{nitrogenous materials}}{\text{starch}} \times 100$, and this is due to interference by the virus in the utilization of the nitrogenous materials and other plastic compounds, to the advantage of the vegetative part of the plant. There is also a marked reduction in the ratio $\frac{\text{magnesium oxide}}{\text{calcium oxide}}$ in the tubers from leaf roll plants, as compared with those from healthy ones.

Beall (G.) & Cannon (F. M.). **The cause of purple-top of Potatoes, as indicated by a study of its distribution within fields.**—*Amer. Potato J.*, xxii, 12, pp. 362–372, 2 figs., 1945.

A statistical study of the distribution of potato purple top [aster yellows virus: *R.A.M.*, xxiv, pp. 284, 406] within tuber-unit plantings demonstrated that the cause may operate variously over a field, but with similar freedom along and across the rows. The condition cannot be simply transmitted from a plant to its neighbour. There was some indication that a regular proportion of plants in each tuber-unit tend to acquire the condition, as if the structure of the mother-tuber, for each unit, were involved.

Limasset (P.). **Sur quelques mosaïques chroniques de la Pomme de terre.** [On some chronic forms of Potato mosaic.]—*Ann. Épiphyt.*, N.S., xi, 1–2, pp. 58–70, 2 figs., 1945.

Evidence is presented from which the author concludes that the mild form of mosaic disease affecting Royal Kidney, Arran Banner, and Doon Star potatoes in

France is due to potato virus X [*R.A.M.*, xxv, p. 8]. The strain from Royal Kidney showed only slight virulence when inoculated into White Burley tobacco and King Edward and Epicure potatoes. The strains from Arran Banner and Doon Star were of the common type of virus X, characterized by ring spot or wavy lines on White Burley tobacco.

LARSON (R. H.) & ALBERT (A. R.). **Physiological internal necrosis of Potato tubers in Wisconsin.**—*J. agric. Res.*, lxxi, 11, pp. 487–505, 1945.

Serious losses to the late commercial potato crop in sandy areas of Wisconsin during hot, dry seasons are due to internal necrosis (physiological brown or rust spot) of the tubers. The disease has much in common with other non-parasitic types of internal necrosis described in other parts of the world, but no attempt at identification has been made in this study.

Affected tubers show no external symptoms and none are observable in aerial parts of the plant. On exposure to transmitted light, however, the lesions in thin tuber sections are translucent and the flesh of thicker sections shows scattered amber to reddish-brown specks, converging to darker flecks or compact dark brown, ragged lesions spread haphazard throughout the pith within the vascular ring or more rarely diffusing from the ring or seeming to follow the lines of the internal phloem. Sometimes the diseased tissues form merely a necrotic mass. The affected areas were found to be hard, corky, and leathery. Internal necrosis was not followed by the formation of cavities or by internal tuber decay either under field or storage conditions; nor should it be confused with the phloem necrosis caused in certain potato varieties by the leaf roll virus, for it is not reticulate; or with the frost necrosis described by Wright and Diehl (*Tech. Bull. U.S. Dep. Agric.* 27, 24 pp., 1927); or the internal mahogany browning observed in some tubers exposed for long periods to moderately low temperatures [*R.A.M.*, xxi, p. 302]. There are, however, macroscopic and microscopic similarities with the yellow-dwarf virus necrosis described by the senior author [ibid., xix, p. 39, and forthcoming paper]. The absence of recognizable external symptoms seriously increases dehydration and chip manufacturing costs.

Anatomical symptoms are discoloration spreading from the corners of the cell walls in the parenchymatous tissues of the internal medulla, followed by cellular disruption (induced by the pressure of protoplasmic accretions on the walls and abnormal cell division) into necrotic areas. This condition was shown microchemically to be invariably associated with suberization. The occurrence of pentoses were noted, but there was nothing definitely to show lignin, cellulose, or solanin accretions in the diseased tissue. Numerous crystals were present.

Necrosis increased progressively during the growing season in degree and severity, lightly covered tubers being much more acutely affected than those with two or more inches of soil cover, and larger potatoes more than smaller. Necrosis did not appear to increase in storage.

Of 22 standard varieties tested, Triumph, Pontiac, and Red Warba showed considerably more resistance to the disease than Katahdin, Rural New Yorker, Russet Rural, or Harmony Beauty.

Straw mulch applications progressively reduced internal necrosis, but no control of the disease was effected by dressings with hydrated lime, artificial fertilizers containing nitrogen, phosphorus, and potash, sulphur, or with salts of boron, iron, magnesium, or zinc, alone or incorporated in a fertilizing preparation.

Environmental conditions affecting the tubers and roots are thought to influence the disease but existing methods failed to differentiate between temperature and moisture effects although it was apparent that fluctuation in these conditions was more important than in factors such as soil type, organic matter, fertility, and soil reaction.

Wiant (J. S.). **Internal black spot of Long Island Potato tubers.**—*Amer. Potato J.*, xxii, 1, pp. 6–11, 2 figs., 1945.

For several years Green Mountain potatoes arriving at market in New York have shown an internal black discoloration of the tubers tentatively attributed by C. O. Bratley and J. S. Wiant (*Plant Dis. Reptr*, xxiv, pp. 154–157, 1940) to bruising injury [cf. *R.A.M.*, ix, p. 54 *et passim*]. In a survey in Suffolk County black spot was noted in tubers graded and sacked but not in ungraded tubers of the same stock, though many of the latter showed flattened areas resulting from pressure. As a result of tests it was shown conclusively that the condition could be produced by mechanically injuring the tubers on the site of bruises apparently caused by pressure from adjacent tubers; conversely, the condition did not develop at the pressure bruises unless the tissues in these areas were mechanically injured after removal of the tubers from their original position in the bin. Temperature was ascertained to play an important part in the development of black spot; when replicate lots of tubers with pressure bruises were kept for three days at 49°, 61°, and 67° F., respectively, then run over the grader, struck on the pressure bruises, and then returned to their respective temperatures for one day, black spot developed to the greatest extent at the lowest temperature and to the least at the highest.

From the first season's work it is concluded that while symptoms resembling black spot can sometimes be induced in certain potatoes by pronounced mechanical injury to normal areas of the tuber, nearly all black spot due to commercial handling originates in pressure bruises. What predisposes potato tubers to pressure bruises has not yet been determined.

Bonde (R.) & Schultz (E. S.). **The control of Potato late blight tuber rot.**—*Amer. Potato J.*, xxii, 6, pp. 163–167, 1945.

After stating that a survey carried out in 1944 showed that approximately 10 per cent. of the total potato crop of Aroostook County, Maine, decayed in storage as a result of late blight [*Phytophthora infestans*: *R.A.M.*, xxiv, p. 113] tuber rot, the authors describe experiments in which Green Mountain potatoes given five or six spray applications during the season were harvested each year, some after mid-September, when the foliage was mature and dying but still partly green, and some later, when the plants had been killed by frost. After about eight weeks' storage, tuber decay in the former (average of eight 50-lb. samples) was 20, 48, and 53 per cent., respectively, in 1942, 1943, and 1944, as against 0, 4, and 6 per cent., respectively, in the latter.

Other tests in 1944 showed that the amount of tuber decay after six weeks' storage in tubers dug (1) while the foliage was still partly green, (2) two days after killing the tops by spraying with sinox, (3) ten days after the same treatment, and (4) after the tops had been killed by frost was $53\pm1{\cdot}8$, $13{\cdot}6\pm1{\cdot}5$, $3\pm0{\cdot}9$, and $0{\cdot}0\pm0{\cdot}0$ per cent., respectively.

It is concluded that most of the late blight tuber rot in Maine results from infection during harvesting while the fungus is still viable on the tops. When late blight is present, the tops should be killed by spraying with a herbicide, or harvesting postponed until the foliage has died off or has been killed by frost.

Reddick (D.) & Peterson (L. C.). **Empire—a blight resistant variety.**—*Amer. Potato J.*, xxii, 12, pp. 357–362, 1945.

A full description is given of a new blight (*Phytophthora infestans*) -resistant potato variety, Empire, produced at Cornell Agricultural Experiment Station, New York. First grown in 1940, it originated as a cross between Rural New Yorker No. 2 and a hybrid seedling partly derived from the immune *Solanum demissum*. Yield tests were carried out in 1944 and 1945 in areas with widely different climatic conditions. Without exception, Empire yielded at least as well as

the standard local varieties, and when blight was a factor, as it was in 1945, it exceeded the standard by two to one.

The new variety is adapted to most parts of New York, but is too late in maturity to be useful on Long Island or in the Adirondacks. In general, it may be regarded as a substitute for Rural. It has been tested repeatedly for immunity by inoculations on young plants in the greenhouse under very severe conditions. On two occasions, however, it has shown a few small blight lesions in the field, which were undetected by experienced growers. They also appeared very late. Although it must be assumed that Empire may ultimately break down it was released to growers of certified seed in January, 1945, on the basis of its performance.

KNORR (L. C.). **Reliability of the stem-ooze test for field identification of Potato ring rot.**—*Amer. Potato J.*, xxii, 3, pp. 57–62, 1945.

To determine the reliability of the stem-ooze test for the diagnosis in the field of the presence of potato ring rot (*Corynebacterium sepedonicum*), i.e., cutting the suspected stem near the point of original seed-piece attachment, squeezing the stem at the cut, and looking for a pearly, milky, viscous exudate at a locus or line between the woody vascular ring and the pith (Eide and Rose: *Minn. agric. Extens. Serv., Folder 95*, 1941), the authors carried out an experiment in which 432 potato plants of 11 varieties were grown from alternating units of ring rot-infected and uninfected seed pieces under two different field environments, planted and harvested on two different dates, and the occurrence of external symptoms noted. The pulled plants were brought to the laboratory, where they were subjected to the stem-ooze test, after which the cut surfaces were smeared on slides for microscopic examination.

The results obtained showed that the percentage of plants correctly diagnosed by external vine symptoms was 85·6, and by the stem-ooze test 97·2. The stem-ooze test is not intended to supplant laboratory examination, but it is certainly an improvement upon field diagnosis dependent on external vine and tuber symptoms alone.

The place of occurrence of true bacterial ooze (as distinct from ooze-like plant juice) is characteristic: it appears at a point or along a line between the woody vascular ring and the pith. In colour it resembles milk, while its consistency varies from that of normal juice to that of coherent little flecks or platelets. A further characteristic of ring rot-invaded stems is that at the locus of oozing the vascular ring is readily separable from the adjacent pith. *Bacterium* [*Xanthomonas*] *solanacearum* and *Erwinia phytophthora* might also be supposed to yield ooze in a test of this kind, but in plants infected with the former a brown stain appears in the diseased vascular ring, while with the latter a marked slimy rot of the basal stem occurs. Neither of these symptoms is caused by ring rot.

MUNGOMERY (R. W.). **Report of the Division of Entomology and Pathology.**—*Rep. Bur. Sug. Exp. Stas Qd, 1944–45*, pp. 20–22, 1945.

In this report [cf. *R.A.M.*, xxiv, p. 205] it is stated that at the end of June, 1945, the only commercial field of sugar-cane in Queensland known to be affected with gumming disease (*Bacterium* [*Xanthomonas*] *vasculorum*) was a second ratoon crop near Cairns. Later, an outbreak was found at Mossman, the most northerly sugar-cane area in Queensland, and every farm in the affected and adjacent areas was supplied with plants of resistant varieties, which include the new Q. 44, Cato, Comus, and Trojan; the older canes, Badila, P.O.J. 2878, D. 1135, and H.Q. 409 are resistant enough to be used. In gumming disease resistance tests at Brisbane C.P. 29/116, Q. 47, Q. 49, and Q. 52 were quite resistant and the New Guinea canes, 28 N.G. 82, 201, 218, 253, and 289 showed no infection, apart from one stalk of 218. Three seedlings from Badila × 28 N.G. 251 were also quite resistant.

For the second year in succession, downy mildew (*Sclerospora sacchari*) was not recorded from the Mulgrave and Hambledon areas. It occurred in Mossman, following flooding from infected fields, where 32 acres were affected, involving the varieties S.J.4, Pompey, and Q. 2. In the Mackay area during the year, all P.O.J. 2878 and Co. 290 canes were inspected in areas formerly infected, but no downy mildew was found. The Bundaberg Cane Pest and Disease Control Board's inspection gangs recorded 1,327 stools of downy mildew for the period under review. Orders for harvesting and ploughing out were issued on the worst blocks. In downy mildew resistance trials in northern Queensland final counts showed no infection on C. 114, C. 150, D. 114, D. 206, D. 233, D. 244, D. 269, D. 277, D. 286, China cow cane, and 32–8560. In similar trials at Bundaberg I. 11, I. 15, Q. 27, Q. 28, Q. 42, Q. 47, Q. 52, and C.P. 29/116 showed no infection. Using P.O.J. 2878 and Reid's Yellow Dent and Golden Beauty maize, the Bureau's workers again obtained evidence that downy mildew is easily transmissible from sugar-cane to maize and vice versa [ibid., xxi, pp. 304, 347].

In the Bundaberg area 7,475 stools were found to be infected with Fiji disease, 3,310 in the quarantined Avondale area, and 1,954 in the Tantitha area. In the Isis area, only four diseased stools were found, and in the Maryborough district the disease was slight and scattered. In the Moreton area the situation was disquieting, nearly 11,000 affected stools being rogued out during the year. A small resistance trial, concluded in July, 1944, showed that Q. 44 was resistant, while Q. 52 and Eros are probably commercially resistant; Q. 45 was about as susceptible as P.O.J. 2878. It was also found experimentally that Q. 47, Q. 49, Toledo, and Trojan showed no infection, while Q. 52 had eight diseased stools in a total of 33, Loethers four in 36, R.P. 8, 13 in 35, and P.O.J. 2878, 22 in 36. Hot-water treatment of the setts, up to the limits tolerated by the buds, did not control the disease.

Leaf scald (*Bact.* [*X.*] *albilineans*) still occurs in the far northern areas. Attacks were fairly widespread on Trojan S.J. 2 and Nanemo were severely affected, and 32–8560, listed as resistant in Hawaii, developed appreciable infection in the propagation plots.

Mosaic is very uncommon in the far north; though present in the Burdekin area, it is not expected to become serious, as active control measures are being taken. In Mackay, it probably occurs on 50 per cent. of the farms, though nowhere seriously. It still occurs in the Bundaberg district, and has increased in the Maryborough area, mainly due to the planting of the tolerant Q. 42.

Red rot [*Physalospora tucumanensis*: ibid., xxv, p. 253] was prevalent in the Moreton area in a very dry period, and probably caused many failures to ratoon in the later-cut blocks of Co. 290.

Chlorotic streak [ibid., xxiii, p. 150] is still serious in most of the northern mill areas and at Moreton, in the south. Almost all the low-lying areas in the north are affected, and the yields are lowered considerably. Prolonged wet weather has caused it to spread over a wider area, and in some localities, including the Mossman district, scarcely a field remained unaffected.

A system of isolation plots has been started in four districts, by which sugar-cane varieties can be transferred from one quarantine area to another in greater quantities than before, thus making new canes available a year or two sooner. If any disease appears the entire planting can be ploughed up without risk of infection to neighbouring crops.

Saint (S. J.). **Report on the work of the Department of Science and Agriculture, Barbados, for the year ending 31st March, 1945.**—17 pp., [1946].

On p. 5 of this report [cf. *R.A.M.*, xxi, p. 161] it is stated that sugar-cane mosaic disease resistance tests in Barbados experiments with the Sein method of artificial inoculation were continued with the object of devising a fool-proof

technique. Plants were exposed to high humidity for periods ranging from 24 to 96 hours both before and after inoculation. The best results follow from 24-hour exposure periods.

Report on the British West Indies Central Sugar-Cane Breeding Station for the year ending September 30th, 1944.—41 pp., [? 1945].

In this report [cf. *R.A.M.*, xxiv, p. 121] it is stated that, in spite of its high susceptibility to mosaic, B. 34104 is the best general-purpose sugar-cane variety in Jamaica. It appears to possess tolerance to the disease. The seedling B. 37172 is highly resistant to mosaic; its field performances are reasonably good, and it is an excellent factory cane. It shows great promise.

Mosaic disease investigations in Barbados seemed to denote several different strains of the virus, but failure to secure infection of B. 37161 with B. 37161 material and of B. 35187 with B. 35187 material indicate deficiencies in the technique used.

Of the B. 41[1] seedlings found to be mosaic-resistant, ten were Glagah derivatives, known to be highly resistant, while the remaining five had the highly resistant 'noble' cane B. 3439 as female parent.

Arruda (S. C.). **As doenças da Cana de Açúcar de S. Paulo (continuação). II. Mosáico.** [The Sugar-Cane diseases of S. Paulo (continuation) II. Mosaic.]—*Biológico*, xii, 1, pp. 21–27, 3 figs., 1946.

The incidence of mosaic in a number of the leading sugar-cane varieties grown in São Paulo, Brazil [*R.A.M.*, xxii, p. 452], is tabulated and discussed. More than half the cane grown for the State factories consists of Co. 290, the percentage of infection in which in seven fields inspected ranged from 60·8 to 100 per cent. The much prized early varieties, P.O.J. 213 and Co. 281, were also fully contaminated, and under local climatic conditions they do not exhibit the marked recuperative powers characterizing them in Louisiana. Of the remaining varieties included in the survey, only C.P. 27/139 and F. 29/7 appear to show any promise as planting material for the future. It is true that the newly introduced American varieties, C.P. 28/11, C.P. 28/19, and C.P. 29/320, are still largely or wholly free from mosaic (12 per cent. infection in the last-named), but their susceptibility to scald [*Xanthomonas albilineans*: ibid., xxiv, p. 432] precludes their use in São Paulo, at any rate for the present.

The writer has never observed *Aphis maidis*, a vector of sugar-cane mosaic, in the cane fields, though it occurs in abundance on maize. On the other hand, *A. sacchari*, which is a common occupant of cane plantations, has not yet been implicated as a carrier of the virus. Alternate hosts of the latter in the State are two kinds of Guinea grass [*Panicum maximum*], known locally as 'marmalade' and 'mattress'.

McM[artin] (A.). **Mosaic disease on Co. 281 and Co. 301.**—*S. Afr. Sug. J.*, xxix, 12, p. 557, 1945.

In February, 1945, a survey of the Natal sugar-cane area revealed the presence of mosaic on Co. 281 [*R.A.M.*, xxiv, p. 166] in the Umhloti Valley on the north coast, and the disease was subsequently detected in a very severe form in the Umzinto district on the south coast, where a few stools of Co. 301 were also attacked. In some fields in the latter region Co. 281 was infected to the extent of 90 per cent. and upwards.

McMartin (A.). **Fungicidal treatments for improving sugar-cane stands.**—*S. Afr. Sug. J.*, xxx, 1, pp. 19, 21, 23, 1946.

This is a summary of the results hitherto obtained in the writer's experiments in the fungicidal treatment of sugar-cane cuttings against pineapple disease [*Ceratostomella pardoxa*: *R.A.M.*, xxv, p. 45]. It is reproduced in *Sugar*, xli, 2, pp. 36–38,

1946, with the addition of supplementary notes on the discussion following the presentation of the original paper at the meeting of the South African Sugar Technologists' Association held at Durban in April, 1945.

Ellis (E. A.). **Flora and fauna of Norfolk. Miscellaneous observations.**—*Trans. Norfolk Norw. Nat. Soc.*, xvi, 2, pp. 172–177, 1946.

The following items are of special interest. Bright orange-yellow uredospores, resembling those of *Coleosporium senecionis* [*R.A.M.*, xxiii, p. 156], appeared on 15 plants of summer chrysanthemum (*Chrysanthemum carinatum*) at Brundall, Norwich, in August, 1945, a new host for Great Britain. *Entyloma fergussoni* produces circular, pale spots on the living leaves of wild and cultivated forget-me-nots (*Myosotis* spp.). It had been collected only a few times in Great Britain, but seems to be rather general in the Yare Valley on *M. palustris* and *M. cespitosa*, where the plants are partially shaded by trees.

Sosin (P.). Матеріали до флоры грибів Кам'янец-подільскої області. [Contributions to the fungal flora of the Kam'yanets-Podilsk province.]—*Бот. Ж. Акад. Наук УРСР.* [*Bot. J. Acad. Sci. U.R.S.R.*], i, 2, pp. 381–386, 1940. [Received April, 1946.]

A list of 38 species of Basidiomycetes, including 14 Polyporaceae, collected from 1932 to 1934, principally in the Tsibulivsk and Ponevetsk forests of the Kam'yanets-Podilsk province is presented in this paper.

Mujica (F.) & Vergara (C.). **Flora fungosa chilena. Indice preliminar de los huespedes de los hongos chilenos y sus referencias bibliográficas.** [Chilean fungus flora. A preliminary index of hosts of the Chilean fungi and their bibliographical references.]—Ministerio de Agricultura, Santiago, 199 pp., 1945.

This valuable contribution to the knowledge of Chilean mycology [cf. *R.A.M.*, xxiii, p. 476 *et passim*] comprises, *inter alia*, a list of fungi, representing 370 genera, arranged under the hosts (which are classified on the lines of Engler and Prantl's 'Die natürlichen Pflanzenfamilien') or substrata, a concordance of the popular and scientific names of the plants enumerated, an alphabetical fungus index, and a 15-page bibliography.

Jenkins (Anna E.) & Bitancourt (A. A.). **Myriangiales selecti exsiccati.**—*Bol. Soc. brasil. Agron.*, vii, 3, pp. 153–166, 1 pl., 1 map, 1944. [English summary. Received April, 1946.]

The contents of fascicle 1 of the Myriangiales Selecti Exsiccati [*R.A.M.*, xxi, p. 428] are summarized and the disposition of the complete and partially complete sets presented to institutions is given. It consists of 50 specimens representing 12 species of *Elsinoë* and *Sphaceloma* known in South America up to 1936 [ibid., xix, p. 366 and xxi, p. 225]. A bibliography of 39 papers brings the previous one [ibid., xxii, p. 179] up to date.

Brodie (H. J.). **Further observations on the mechanism of germination of the conidia of various species of powdery mildew at low humidity.**—*Canad. J. Res.*, Sect. C, xxiii, 6, pp. 198–211, 7 figs., 1945.

The author first summarizes the available data [*R.A.M.*, xvi, p. 104; xxi, p. 261] on the germination of conidia in relation to humidity. The tables relate to nine species of powdery mildews from 21 different hosts and include the following new observations: *Erysiphe graminis*, from five different hosts, was found capable of germination in relative humidities ranging from 0 to 65 per cent.; *Microsphaera alni* from lilac (*Syringa vulgaris*) in relative humidity 35 to 63 per

cent.; *Uncinula salicis* from poplar (*Populus balsaminifera*) in relative humidity 33 to 62 per cent. For each test the temperature and time of year at which the tests were made are given. It is noted that ability to germinate in low humidity differs in conidia of the same species from different hosts, and that although in laboratory tests five species were apparently unable to develop in low humidities yet they are observed commonly in the field in hot, dry weather, e.g., *E. cichoracearum* on *Helianthus* spp.

Experiments with spores of *E. graminis*, in which 300 single spores and a like number of catenulate ones were used, demonstrated in every case that the germination was considerably lower for catenulate than for single, detached conidia. In addition, the longer a conidial chain might be, the less prospect there was of spores germinating, but in those cases where germination was effected, it took place at the end of the chain. In three- or more-spored chains germination began at both ends. The author considers the lower germination of catenulate conidia as a phenomenon to be expected on the basis of previous work [loc. cit.] on the respiratory exchange of gases during germination; the filtration of gases through the terminal to the intercalary conidia may be so slow that, as evidenced by the results of these experiments, no germination takes place at all in these.

The work of Brodie and Neufeld has been carried further in the present studies in efforts to establish the apparent osmotic pressure of the cell sap of conidia of *E. polygoni* (the qualification 'apparent' being employed by the writer because of the special nature of the conidial protoplast) and of *E. graminis* var. *hordei*. Considerable contraction of the conidia took place in strong sucrose solution, and this is thought to account for the fact that there was no plasmolysis in either species. However, in experiments with increasingly strong solutions of potassium nitrate, plasmolysis was achieved and the apparent osmotic pressures of the conidial cell sap obtained were, for *E. polygoni*, about 63 and for *E. graminis hordei* about 68 atm., which are higher than previous records for fungi seen by the author in the literature available to him. If the conidial protoplast in the Erysiphaceae is lacking in much free water, as was thought probable by the writer and Neufeld, and the cell sap in the conidium is concentrated, the absorption of water from relatively dry atmospheres might be assisted by high osmotic pressures. In the presence, however, of protoplasmic density, with possibly, hydrophylic colloidal materials, some intake of water by the germinating spores might take place by imbibition; but neither this nor high osmotic pressure can have much significance when germination occurs in an absolutely arid atmosphere, and the results of further investigation of the protoplastic substances are awaited before any serious explanation of this question can be attempted.

Structural studies of the papillae of the conidia of *E. polygoni* and *E. graminis* suggest that they should not be regarded as germ pores but as structures having a special function representing the point of respiratory exchange in an otherwise impenetrable cell wall.

The apparent failure to germinate of the conidia remaining on the parent conidiophore after abstriction of the terminal one is held possibly to be due to the papilla of the remaining terminal conidium undergoing some change rendering it impermeable.

FIORE (MARIA). **Strano comportamento di un Hyphomycete della famiglia delle Dematiaceae.** [The strange behaviour of a Hyphomycete of the family of the Dematiaceae.]—*Nuovo G. bot. ital.*, N.S., xlvii, 2, pp. 448–450, 5 figs., 1940. [Received April, 1946.]

In the course of cultural studies on a disease of *Opuntia ficus-indica*, media inoculated with pieces of affected material showed the presence of a white, subhyaline mycelium with a few scarcely perceptible septa, the hyphae measuring 3 to

5μ in diameter. In less than a fortnight the hyphae became brown, 5 to 6μ in diameter, and multiseptate.

From this culture the author obtained two series of subcultures on different media: in all cases, the same mycelium resulted, with the same gradual transformation. Finally, conidia resembling those of an *Alternaria* developed. Other subcultures were kept in the dark for about 40 days, when it was found that almost all the *Alternaria* conidia contained endospores and were changed into sporangia. These endospores were spherical, 3μ in diameter, and with brown walls; the number varied according to the size and number of the septa in the conidium-sporangium containing them; and they emerged through the apex or at any point in the walls. The change from conidia to sporangia is attributed to unfavourable environmental conditions.

GADD (C. H.). **Report of the Mycologist for 1944.**—*Bull. Tea Res. Inst. Ceylon* 26, pp. 23–30, 1 pl., [? 1945].

In this report [cf. *R.A.M.*, xxiv, p. 121] it is stated that in Ceylon lightning frequently causes the death of tea bushes [ibid., xi, p. 749] in patches of up to 100, never in isolated plants. The plants die successively, and the affected area appears as if attacked by some virulent root disease. Wilting and dying occur characteristically some time after the electric storm has passed. The discoloration in the cortex and wood of affected bushes [loc. cit.] is probably indicative of damage to the delicate water-absorbing parts of the roots.

During the year, one estate reported the death of numerous tea bushes, apparently caused by root disease possibly originating from jak [*Artocarpus integrifolia*] trees. In some patches the condition was rapidly spreading. Two bushes were examined in the laboratory: one was completely dead, but showed no sign of parasitic root disease, the other had living roots, some with characteristic symptoms of lightning injury. All the jak trees except one appeared to be healthy. The patches of affected tea varied in size from areas containing 20 to 30 bushes to areas three or four times as large, each without exception at the foot of a jak tree. Bushes from 13 patches all showed lightning symptoms on the roots. It is suggested that the jak trees had acted as lightning conductors while themselves remaining uninjured.

In a report by T. E. T. BOND an indication that the total range of phloem necrosis [ibid., xxiv, p. 207] may still be increasing was afforded by a new estate record of the disease (the first since 1941) and by the receipt of a severely affected bush from an elevation of 3,500 ft., distinctly below the altitude at which easily recognizable symptoms are generally found. Much interest attaches to the discovery of an undoubtedly necrotic seven-year old supply bush in a Kandapola clearing, the first authentic case of the kind recorded. The external and internal symptoms were typical of an advanced stage of the disease. The bush was at the top of the clearing, about 20 ft. away from old, heavily necrotic tea. This occurrence finally refutes the common belief that phloem necrosis is due to old age.

Further confirmation was obtained that, in general, the disease is absent from high jat bushes and prevalent in medium to low jat bushes. A high jat bush is not necessarily resistant, however, nor is a low jat bush necessarily susceptible.

MCKINNEY (H. H.) & CLAYTON (E. E.). **Genotype and temperature in relation to symptoms caused in Nicotiana by the mosaic virus.**—*J. Hered.*, xxxvi, 11, pp. 323–331, 6 figs., 1945.

As a result of the extreme variation in the expression of local and secondary necrosis in species of *Nicotiana* [*R.A.M.*, xxi, p. 227] and in breeding lines of tobacco carrying the necrosis factor (N), the authors undertook a series of experiments with seven species of *Nicotiana* carrying this factor, inoculating them with

the tobacco mosaic virus in cultural conditions at several temperatures for the purpose of determining environmental influences.

They conclude that the so-called *glutinosa*-type of resistance appears to be determined by a gene-controlled temperature-response mechanism which regulates the expression of the necrosis and the mosaic factors present. With the possible exception of *N. repanda*, whose behaviour suggested that the necrosis factor may be isolated from the mosaic factors, each species investigated carries one or more factors for mosaic susceptibility, the presence of which can only be detected at temperatures [ibid., xxi, p. 101] above those favouring severe secondary necrosis. Attempts to effect a cross with *N. tabacum* were unsuccessful. When the *N* factor was transferred to plants carrying the mosaic-resistance factors from Ambalema and T.I. 448 [ibid., xxii, pp. 376, 599] tobaccos, secondary necrosis at high temperatures was greatly reduced or eliminated, with marked control of mosaic. It appeared that the transfer of the *NN* gene from *N. glutinosa* to *N. tabacum* involves an entire chromosome [ibid., xxiii, p. 152]; whether lines carrying the *N* factor are superior to those carrying the mosaic-resistance factors from Ambalema or T.I. 448 tobaccos is therefore not yet clear.

McKay (R.). **'Flue dust' as an agent in the production of sun scald on Tomato seedlings.**—*J. Dep. Agric. Éire*, xlii, 2, pp. 233–235, 4 figs., 1945.

After pointing out that sun scald on tomato seedlings [*R.A.M.*, xix, p. 49; xxii, p. 68; xxiii, p. 413] is rare in Ireland, the author states that in the first week of March, 1944, he received from a grower a box of tomato seedlings affected by the disorder which was thought to be damping-off. Bare patches were present, caused by the collapse of the seedlings at soil-level. Many fallen plants showed severe stem constriction, while others showed a white mark on the stems slightly above soil-level. The compost used in the boxes was very dark and fine on the surface, as a result of mixing 'flue dust' (a by-product from cement works) before sowing.

Further development of the trouble was prevented by sprinkling sand over the soil surface. In September, 1944, and again in March, 1945, the condition was reproduced several times by mixing flue dust with the compost used for raising tomato seedlings or by adding a layer of it to the surface of seed-boxes, and exposing the boxes to direct sunlight in each case. Controls without flue dust remained unaffected, as did seedlings raised in compost mixed with flue dust but kept shaded or continuously moist. The worst sun scald developed when the surface layer of the boxes to which the flue dust was added was allowed to become dry.

Tucker (C. M.). **Phloem necrosis, a destructive disease of the American Elm.**—*Circ. Mo. agric. Exp. Sta.* 305, 15 pp., 8 figs., 2 maps, 1945.

Particulars are given of the distribution of elm phloem necrosis in 24 counties of Missouri [*R.A.M.*, xxiv, p. 126], where the vase, moline, and holly-leaf varieties of the American elm are all susceptible. The available information on different aspects of the disease is summarized.

Boudru (M.). **A propos de la forme supérieure de Brunchorstia destruens Eriksson.** [On the higher state of *Brunchorstia destruens* Eriksson.]—*Bull. Soc. for. Belg.*, lii, 12, pp. 244–253, 1945.

After describing the fructifications of *Brunchorstia destruens*, *Cenangium ferruginosum* (syn. *C. abietis*), *Crumenula pinicola*, and *C. abietina*, and critically discussing the investigations made by various workers into the relationship of these fungi, the author cites C. A. Jørgensen's contribution to the subject [*R.A.M.*, x, p. 272], and concludes that *Cenangium ferruginosum* and *Crumenula pinicola* have no imperfect state and are not genetically related to *B. destruens*; the perfect state of *B. destruens* is *C. abietina* [ibid., xxiii. p. 200].

Gäumann (E.). **Über die Pilzwiderstandsfähigkeit des roten Buchenkernes.** [On the fungal resistance of the red-heart of Beech.]—Reprinted from *Schweiz. Z. Forstw.*, [xcvii], 1–2, 10 pp., 1 fig., 1946. [French summary.]

Whereas some workers claim that the wood of beeches affected by 'red-heart' [*R.A.M.*, xxiii, p. 201] is more resistant to fungal infection than that of normal trees, others maintain the contrary. The results of the author's experiments, involving the exposure of disks of 'red-heart' and sound wood to infection by *Polyporus vaporarius* [*Poria vaporaria*], *Coniophora cerebella* [*C. puteana*], *Polystictus versicolor*, and *Stereum purpureum*, indicate that resistance depends on the degree of progress reached in the formation of the red wood. It is not promoted in the early stages of the process, attains a climax with the maximum production of 'red-heart', and then declines. These observations afford an explanation of the divergent reports concerning the reaction to fungal pathogens of 'red-heart' beech wood.

Kind (A.). **Die Säure-Produktion von Pilzen und deren Einfluss auf mit Kupfersulfat imprägnierte Hölzer.** [The acid production of fungi and its influence on timbers impregnated with copper sulphate.]—*Bull. schweiz. elektrotech. Ver.*, xxxv, 7, pp. 174–176, 3 graphs, 1945.

Gäumann drew attention in 'Tagesfragen der Mastenimprägnierung', 1935 (p. 8), to the production of acids by various wood-destroying fungi in the course of their development, and Rabanus (*Holz Roh-u. Werkstoff*, iii, 7–8, 1940) conducted intensive studies on this aspect of timber impregnation. He found that a number of fungi, notably *Polyporus vaporarius* [*Poria vaporaria*], produce oxalic acid in sufficient quantities to inactivate the copper sulphate on treated wood on an alkaline medium. These observations have a practical bearing on timber preservation in Switzerland, where copper sulphate is almost exclusively used for this purpose, and point to the necessity of obtaining information on the geographical distribution of wood-destroying fungi within the country, as well as on the nature of the soil in which the telegraph poles, etc., are to be set. In districts where *Lenzites* spp. predominate satisfactory results may be expected from the copper sulphate treatment, but the chemical processes initiated in alkaline soils by *P. vaporaria* and other oxalic acid-forming fungi are likely to impair its efficacy.

Markham (R.) & Smith (K. M.). **A new crystalline plant virus.**—*Nature, Lond.*, clvii, 3984, p. 300, 2 figs., 1946.

An apparently previously undescribed virus affecting turnips and referred to as 'turnip yellow mosaic virus' is stated to produce as its chief symptom on this host a bright yellow and green mosaic mottling. Chinese cabbage (*Brassica chinensis* var. Chihli) is also susceptible, reacting to attack with a brilliant white, yellow, or green mottling which resembles a variegation rather than a mosaic.

The virus was successfully isolated by a method which is described in detail. It was ascertained to be present in a high concentration in the host, and to be infectious at dilutions of 1×10^{-5}. It did not appear to be transmitted by insects, but there was some evidence that it was seed-borne to the extent of 2 to 3 per cent.

The virus crystals are very small, isotropic, apparently octahedral, and dissolve readily in water to give a colourless, opalescent solution. The phosphorus and carbohydrate content are those of a nucleoprotein containing about 16 per cent. of nucleic acid of the ribose type.

Stapp (C.). **Bakterielle Rübenfäulen.** [Bacterial Beet rots.]—*Zbl. Bakt.*, Abt. 2, cvi, 20–24, pp. 419–426, 2 figs., 1944.

From wet-rotted fodder beets of the Dänische Barries and Rote Eckendorfer varieties originating in south Germany, as well as from similarly affected turnips

sent by H. L. Werneck from Upper Austria (the latter disease was described in *Landeskultur*, 3–4, 1938), the writer isolated a bacterium corresponding in its morphological, cultural, biophysical, and physiological characters with *Bacterium phytophthorum* [*Erwinia phytophthora*]. Five of the nine beet isolates fell into the sixth serological subgroup of wet rots [*R.A.M.*, xiii, p. 100], while three new subgroups had to be erected for the accommodation of the remaining four and the two turnip strains. Control of the disease should be based on precautions against injuries, e.g., by agricultural implements and insects, through which the pathogen gains ingress to the host, sparing use of nitrogenous manures, and a properly regulated crop rotation.

GIDDINGS (N. J.). **Some factors influencing curly top virus concentration in Sugar Beets.**—*Phytopathology*, xxxvi, 1, pp. 39–52, 1 fig., 1946.

In studies at the Division of Sugar Plant Investigations, United States Department of Agriculture, the curly top virus concentration was found to be much higher in infected susceptible (S.L. 842) than in infected resistant (S.L. 68) sugar beets [*R.A.M.*, xxiv, pp. 83, 130], these observations applying both to the highly virulent strain 1 and the relatively innocuous 2. The difference in virus concentration between resistant and susceptible plants was much greater in the case of strain 2 than in that of 1. In both susceptible and resistant varieties the virus concentration was much higher in plants infected by the highly virulent strain than in those infected with the milder one. After three to eight months the plants harboured a much lower virus concentration than those examined between the third and the twelfth week; this was true for both strains 1 and 2 and regardless whether the source plant was resistant or susceptible. The X^2 test shows high significance in all these virus-concentration differences. The lower virus concentration in the resistant varieties is a favourable factor, since it reduces the rate of spread of curly top among such populations. In all groups studied the fact that resistant sugar beet test plants showed more striking evidence of differences in virus concentration than susceptible plants indicates the possibilities of mass action as a factor in infection [see next abstract].

GIDDINGS (N. J.). **Mass action as a factor in curly-top virus infection of Sugar Beet.**—*Phytopathology*, xxxvi, 1, pp. 53–56, 1946.

Experimental evidence is presented in support of the view that mass action is an important factor in the production of curly top either in the resistant S.L. 68 or the susceptible S.L. 842 sugar beet variety [see preceding abstract]. If the active mass of the virus introduced into the plant suffices to induce predominant reactions, the final result is multiplication of the inoculum and consequent infection. A smaller virus mass initiates reactions similar in kind but too limited in degree to permit of virus multiplication. On this hypothesis, the amount of active virus mass required to induce infection would vary with individual plants and, more especially, with different varieties because of differences in the active mass of the specific reacting substances in the host. As already observed, the latter elements tend to increase with age. It is apparent, therefore, that the cultivation of resistant beet varieties and the eradication of weeds acting as virus reservoirs are valuable aids to the reduction of the amount of inoculum available to the leafhopper vector [*Eutettix tenellus*].

SEVERIN (H. H. P.), HORN (F. D.), & FRAZIER (N. W.). **Certain symptoms resembling those of curly-top or Aster yellows, induced by saliva of Xerophloea vanduzeei.**—*Hilgardia*, xvi, 7, pp. 337–360, 8 pl., 1945.

This tabulated account, arising out of investigations on the leafhopper vectors of aster yellows virus, in which the leafhopper, *Xerophloea vanduzeei*, was tested,

shows that, even when *X. vanduzeei* was reared entirely on healthy asters and was presumably non-infective, symptoms closely resembling those of yellows appeared. Tested on sugar beets, the insect caused some symptoms like those of curly top [*R.A.M.*, iii, p. 537; viii, p. 694; ix, pp. 573, 574], even though it had not been allowed to feed on curly top plants. The effects produced by the feeding of this insect are not likely to be of commercial importance either on beets or asters. Nevertheless, the fact that disorders so closely simulating curly top and aster yellows are produced when apparently the viruses are not present suggests that definite identification of these two diseases is not possible from symptoms alone. Also, similar situations may exist with other sucking insects or syndromes.

In the course of experiments it was shown that the feeding of *X. vanduzeei* on sugar beet induced vein-clearing, previously regarded as a characteristic symptom of curly top. On asters (*Callistephus chinensis*) it induced cleared venation with yellow veinbanding, stunting of the plants, development of axillary shoots from the bud in the leaf axil, and virescence of the flowers, all symptoms of aster yellows. The most striking effect produced is breaking in the colour of the petals. Experiments to inoculate mechanically the leaves, midrib, and petioles of healthy beet seedlings and asters with sap from affected plants were unsuccessful, and known vectors of curly top and aster yellows failed to transmit the causative agent.

In both sugar beets and asters the active principle is systemic and presumed due to a toxic salivary secretion.

Gerritsen (J. D.) & Burgmans (H.). **Ascochyta-ziekten bij Erwten (voorloopig onderzoek naar de vatbaarheid van land- en tuinbouwerten).** [*Ascochyta* diseases of Peas (preliminary study on the susceptibility of field and garden Peas).]—*Tijdschr. PlZiekt.*, xlvi, 2, pp. 57–82, 1940. [Received February, 1946.]

Three fungi are concerned in the etiology of anthracnose of peas in Holland, namely, *Ascochyta pisi*, *A. pinodella*, and *Mycosphaerella pinodes* [*R.A.M.*, xii, p. 483], of which the first- and last-named are of considerable economic importance, being probably in some measure pathogenic to all the cultivated varieties. Weather conditions play a decisive part in the development of infection, which is specially favoured by damp summers.

Of the field pea varieties studied from 1932 to 1936 the Schokker types were the most susceptible to *A. pisi* and Mansholt's cross-bred extra short the least so, both to this species and *M. pinodes*, while Mansholt's Corona was also fairly resistant to *A. pisi*. The horticultural varieties sustained heavier damage than the field peas, the tall Nunheims Hekkensluiter being much the most resistant of those investigated. The injury inflicted by *A. pisi* appears to be mainly limited to seed production, which suffers both quantitatively and qualitatively. *M. pinodes*, on the other hand, may attack and destroy very young seedlings through foot rot. Noll has shown that *A. pinodella* behaves similarly to *M. pinodes* in this respect in Germany [ibid., xix, p. 510], and it would therefore be advisable to take account of the former species in further varietal trials in Holland.

Van Beekom (C. W. C.). **Vatbaarheidsverschillen voor koprot (Botrytis spp.) in het nederlandsche Uiensortiment.** [Differences in susceptibility to head rot in the Dutch Onion assortment.]—*Tijdschr. PlZiekt.*, xlvi, 6, pp. 208–211, 1 pl., 1940. [Received February, 1946.]

In two field tests on the susceptibility to the storage rot caused by *Botrytis* spp. of two types of onion [*R.A.M.*, xxv, p. 90], viz., the Rijnsburg and North Dutch straw-yellow and the Zeeuw brown, the average infection in the seven varieties of the former was 3·60 and 2·83 per cent. compared with 1·95 and 1·3 in the four of the latter. These results confirm previous observations in the United States [ibid.,

vi, p. 267] and Holland (*Versl. PlZiekt. Dienst Wageningen*, 90), as to the higher resistance of the coloured varieties, but the writer does not think the differences would be so marked in the case of very severe infection.

FREITAG (J. H.) & SEVERIN (H. H. P.). **Insect transmission, host range, and properties of the crinkle-leaf strain of western-Celery mosaic virus.**—*Hilgardia*, xvi, 8, pp. 361–371, 1 pl., 1945.

A mosaic disease apparently different from western celery mosaic [celery mosaic: *R.A.M.*, xviii, p. 369], first observed in the Santa Clara valley of California in November, 1937, showed symptoms resembling the latter disease except that the leaves were usually severely crinkled. It has been found only rarely during routine observation of celery fields. The first symptom is a clearing of the veins on the youngest leaves about ten days after inoculation, followed by a conspicuous yellow veinbanding, with green interveinal areas, narrow at first, but becoming gradually broader and diffuse in outline. The vein-clearing and -banding are often limited to the basal portion of the leaflets, although the whole leaf area may become affected. The interveinal areas become chlorotic, coalesce with the yellow veinbanding to form large amber-yellow areas, resembling celery calico symptoms [ibid., xxii, p. 207]. More obvious symptoms are crinkling of the leaflets and pustulous excrescences, irregular in shape and size, enclosed by chlorotic areas, often in the tissue between yellowed veins. Downward or upward curling of the leaf margin was observed on the youngest leaves of infected plants, producing clearly defined crinkling.

The host range of celery crinkle-leaf-mosaic virus is confined to the Umbelliferae: celery, celeriac, dill (*Anethum graveolens*), salad chervil (*Anthriscus cerefolium*), caraway (*Carum carvi*), coriander (*Coriandrum sativum*), parsnip, anise (*Pimpinella anisum*), and nine varieties of carrot.

The virus, which was thermally inactivated at 60° C. in 10-minute exposures, was found to be more readily transmitted by mechanical inoculation than by the two aphid vectors, *Myzus persicae* and *Macrosiphum solanifolii*, used in these experiments. Only 6 out of 11 species of aphids tested proved capable of transmitting the virus, and these infected only 8·1 per cent. of the plants inoculated. Further studies of host ranges, properties, aphid transmission, and mechanical inoculation, led to the conclusion that the celery crinkle-leaf-mosaic is a strain of western celery mosaic virus.

FREITAG (J. H.) & SEVERIN (H. H. P.). **Transmission of Celery-yellow-spot virus by the honeysuckle aphid, Rhopalosiphum conii (DVD.).**—*Hilgardia*, xvi, 8, pp. 375–387, 2 pl., 1 fig., 1945.

Celery yellow spot, first reported in the summer of 1934 in Santa Clara valley and since noted in neighbouring districts, causes little loss to growers, although an incidence of 40 per cent. may occur, as the plants are only slightly stunted and no more than the removal of the spotted outer leaves is required before marketing.

In the course of studies on the disease, celery plants were inoculated by means of the honeysuckle aphid (*Rhopalosiphum conii*). The first and most typical symptoms were observed in the greenhouse 14 days later, as multiform, pale green patches, mottling, or streaks, very soon becoming yellow, usually following the veins, or dotted sporadically over the leaf surface. Round, chlorotic areas occur and may coalesce to form larger spotted ones, which may turn white with leaf maturity. The subepidermal tissues of white-mottled petioles of artificially inoculated plants have brown specks along the veins.

The aphids may retain the virus for 12 days, usually losing the capacity to transmit on removal from the infected host, although several species harbour viruses for 3 to 29 days [*R.A.M.*, viii, p. 804].

The virus, isolated from 25 field-infected poison hemlock plants (*Conium maculatum*), which were symptomless carriers of the disease, was transmitted by *R. conii* to 125 out of 205 celery plants, but attempts at artificial transfer from infected poison hemlocks to healthy ones and from celery to celery, using nine species of aphids and mechanical inoculation, were unsuccessful, although 615 celery plants were tested. The disease was transmitted to 37 out of 85 (43·5 per cent.) celery plants and 14 out of 54 (25·9 per cent.) poison hemlocks by means of honeysuckle aphids obtained on naturally infected *C. maculatum* plants. Low infection capacity of artificially infected poison hemlocks was demonstrated in aphid-transmission experiments. Failure to recover the virus from celery is tentatively attributed to low virus concentration in the celery plant or to plant tissue relations inhibiting aphids from acquiring the virus.

Atkins (F. C.). **Verticillium on Mushrooms.**—55 pp., 5 pl. (1 col.), 7 figs., 1 diag., Mushroom Growers Association, Midlands Group Publications, Yaxley, Peterborough [? 1945]. 5s.

In this paper the writer has assembled the available information on the mushroom disease caused by *Verticillium malthousei* [*R.A.M.*, xxv, p. 93], with special reference to its commercial aspects, introduction, prevention, and control. Appended are excerpts from 'Control of Mushroom diseases and weed fungi' by W. S. Beach [ibid., xvii, p. 791]; 'Soil sterilization' in the Ministry of Agriculture's Advisory Leaflet 319, 1945; McG. Bulloch's directions for the microscopic examination of mushrooms for *Verticillium*; and a full reproduction of W. M. Ware's 'A disease of cultivated Mushrooms caused by *Verticillium malthousei* sp. nov.' [ibid., xiii, p. 286].

Ciferri (R.). **Immunità istochimica, effetto micronutritivo e potere anticrittogamico del rame.** [Histochemical immunity, micronutritive effect, and fungicidal power of copper.]—*Boll. Staz. Pat. veg. Roma*, N.S., xxi, pp. 175–183, 1941. [Received February, 1946.]

Some indication having been obtained that vine leaves treated with Casale mixture [*R.A.M.*, xix, p. 581; xxi, p. 240] contain, after careful removal of the deposit from the leaf surface, more copper in the dry ash than leaves treated with Bordeaux mixture and other preparations containing copper [ibid., xxii, p. 287], it has been suggested that the absprbed copper may exert some fungicidal effect against mildew [*Plasmopara viticola*]. Quartaroli, for instance, found that resistance to *P. viticola* was associated with high copper content and has suggested that the insertion of copper wire in the root-layer may permanently prevent infection. The author brings forward detailed arguments against this view, and concludes by stating that the relation between the copper present in the ash of vine leaves and increased resistance to mildew may, if confirmed, indicate, perhaps, an increased stimulation of the vine metabolism by the metal.

Statutory rules and orders, 1946, No. 335. Destructive Insect and Pest Acts, England. The Sale of Strawberry Plants and Blackcurrant Bushes Order, 1946. Dated March 8, 1946.

With the object of preventing the distribution of virus-infected stocks the Sale of Strawberry Plants and Blackcurrant Bushes Order of 8th March, 1946, coming into operation on 1st October, 1946, prohibits the sale in England and Wales of black currant bushes and strawberry plants except those originating from stocks certified not earlier than the previous 1st June under the Ministry of Agriculture's certification scheme or comparable projects administered by the other Agricultural Departments of the British Isles.

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FREITAG (J. H.) & SEVERIN (H. H. P.). **Poison-hemlock-ringspot virus and its transmission by aphids to Celery.**—*Hilgardia*, xvi, 8, pp. 389–410, 4 pl., 1945.

A common umbelliferous weed, poison hemlock (*Conium maculatum*), was found naturally infected with a ring-spot virus in the course of a search for a weed reservoir of the western celery mosaic virus [celery mosaic virus: *R.A.M.*, xviii, p. 369]. The most characteristic features of this disease are chlorotic lines, often surrounding green areas of the leaf surface, and developing from primary symptoms associated with the appearance on the intermediate leaves of artificially infected plants of small, pale green areas, which are usually irregular in shape and scattered and tend to become larger and may show chlorosis, usually observed more along the margin or apical region than near the leaf base. No stunting is seen under field conditions, but the leaves along the midrib are often curled downward and exhibit characteristic mottling with ring-spot markings.

The following were successfully infected by means of the honeysuckle aphid (*Rhopalosiphum conii*): celery, celeriac, dill (*Anethum graveolens*), salad chervil (*Anthriscus cerefolium*), coriander (*Coriandrum sativum*), carrot varieties, parsnips, and varieties of parsley. The virus was recovered from these plants and transferred to healthy celery.

In the course of experiments the ring-spot virus was shown to be systemic in celery; parsley was artificially infected with it from parsley in 14·1 per cent. of the tests undertaken, but attempts at transmission from poison hemlock and celery failed. Further experiments showed that 11 species of aphids breeding on celery are carriers of the virus; that four out of five aphids which do not breed on celery or poison hemlock were unable to transmit it; while the fifth, *R. pseudobrassicae*, infected one out of 25 plants; and that the honeysuckle aphid, during feeding periods of 10 to 15 minutes, proved a vector in a few of many tests. Honeysuckle aphids, hitherto not known to transmit the virus, when fed hourly on nine healthy celery plants, commonly transmitted it to the first plant fed on, but infected later plants only to a small extent. Four aphid species were found to lose the virus during the first 24 hours on healthy plants, five showed a low percentage of infection during a second 24 hours, and none transmitted it after 48. These same aphids proved capable of recovering the virus from plants three days after inoculation and, as the incubation period was seven days, thus showed that they could acquire the virus before the symptoms appear. Aphids acquired the virus as easily during 181 to 200 days after infection as during the first 20 days.

NUSBAUM (C. J.). **Internal cork, a new disease of Sweet Potato of unidentified cause.**—*Phytopathology*, xxxvi, 1, pp. 18–23, 2 figs., 1946.

In the spring of 1944, Porto Rico sweet potatoes were found to be widely affected in South Carolina by an internal corky spotting, which usually became apparent only on sectioning the roots, though an occasional cavity developed on the surface above an immediately underlying lesion. The dark brown to black,

hard spots may attain a diameter of about 3 cm. and rarely exceed 5 cm. in length. The examination of fixed and stained material of the larger lesions revealed an irregular central area of collapsed cells, surrounded by a phellem layer in which the presence of suberin in the cell walls was detected by the reddening of the tissues treated with Sudan IV. The remains of disorganized xylem vessels were sometimes found in the necrotic zone. The ventral surfaces of the older leaves of plants with corky roots sometimes bore conspicuous purplish, circular spots with greenish centres, probably, but not certainly, correlated with the internal symptoms. Culturable pathogens and boron deficiency having been excluded as causes of the disease, the implication of a virus in its etiology is suspected.

BLACK (L. M.), PRICE (W. C.), & WYCKOFF (R. W. G.). **The electron micrography of plant virus-antibody mixtures.**—*Proc. Soc. exp. Biol., N.Y.*, lxi, 1, pp. 9–10, 4 figs., 1946.

Shadowed electron micrographs of mixtures of purified southern bean mosaic and tomato bushy stunt [*R.A.M.*, xxv, p. 25] viruses with their specific antisera reveal their spherical elementary bodies aggregated into microflocs, in which the particle separations appear to be about twice their normal values. A more detailed study of the systems is in progress.

BAWDEN (F. C.). **Virus diseases of plants.**—*J. R. Soc. Arts*, xciv, 4710, pp. 136–168, 21 figs., 1946.

In this paper, based on three lectures delivered before the Royal Society of Arts, London, in November and December, 1945, the writer, after an introductory discussion of the meaning of the term 'virus', deals with the external symptoms of virus diseases in plants, virus strains and mutation, internal symptoms, methods of transmission, factors affecting spread in the field, seed transmission, purification, chemical and physical properties, sizes of virus particles, and multiplication.

WILLIAMS (P. H.), SHEARD (ENID), SELMAN (I. W.), & OWEN (O.). **Plant diseases.**—*Rep. exp. Res. Sta. Cheshunt, 1944*, pp. 21–31, 1945.

In the opening section of this report [*R.A.M.*, xxiv, p. 89], P. H. WILLIAMS records that in 23 per cent. of the total number of specimens received (of which 549 or 86 per cent. were tomatoes) *Phytophthora* spp. proved to be the causal agents of the diseases present.

Reports that the pathogenicity of *Verticillium* wilt of eggplants was reduced by altering the acidity of the soil by sulphur or lime amendments suggested experiments to determine the effect of acidity of the medium on strain 57, a culture of *V. albo-atrum*, and strain 49, a single-spore culture of *V. dahliae*. The results, which are tabulated, show good growth of the fungi between P_H 4 and 8, but growth was arrested or inhibited below P_H 4. It does not seem possible therefore to acidify the soil sufficiently to induce an unsuitable habitat for *Verticillium*.

In 1942, with a view to testing the possible seed transmission of *Verticillium* wilt, Ailsa Craig tomato plants, set in 10-in. pots on 23rd April were infected under the ball of the roots with cultures of *V. albo-atrum* or *V. dahliae*. By 22nd May severe wilt symptoms had developed in those inoculated with *V. albo-atrum*, but they recovered. The plants inoculated with *V. dahliae* showed no infection until the characteristic yellowing of the lower leaves became evident on 1st June. Regular growth, however, continued, accompanied by no signs of malformation. Further experiments in 1944 gave similar results. In experiments to detect the transmission of *Verticillium* wilt by tomato seeds from infected plants no fungal growth was obtained either from seed surfaces or from the tissues of young seedlings. Nevertheless, seed-saving from healthy plants only is recommended.

For 11 counties 19 records of infection by *V. albo-atrum* and 9 by *V. dahliae* were reported during 1943, all records of the second coming from southern England.

E. Sheard reports outbreaks of stem rot of tomato (*Didymella lycopersici*) in 112 nurseries in 24 counties, infection taking place between mid-March and the end of April and being restricted apparently to the base of the stems, seldom below soil-level; later infections occurred at higher levels. It recurred even where the soil had been steamed or treated with formaldehyde or proprietary sterilizers.

In temperature experiments, pure cultures of *D. lycopersici* were held at 15° C. for three days and then incubated at 35°, several plates being returned daily to 15°. Growth, which ceased at 35°, was resumed at 15°, but only half the cultures resumed growth after five days at 35° and the thermal death point was reached after six. This result is valid only for the vegetative growth of the fungus in pure culture.

Viability tests with pycnospores showed that germination could be obtained in tomato juice 15 to 17 days after drying. From pycnidia on pieces of stem tissue, removed from diseased tomato plants and kept dry in glass tubes at room temperature, prolific sporulation took place immediately the pycnidia were placed in water and spores were still viable after eleven months. Thus, infected plant debris, neglected when cleaning out houses and in sterilizing soil, presents a potential source of infection for the following season's crop. The same danger arises from infected refuse from field-grown tomato plants and haulms left in rubbish heaps.

E. Sheard describes an infection of heliotrope [*Heliotropium peruvianum*] by *Corticium solani* and considers that this may be the first record of the pathogen on this host. Serious loss of heliotrope cuttings grown in steam-sterilized soil was attributed to their being reared in old, unsterilized boxes. No recurrence was reported when new boxes were used.

I. W. Selman's report on the susceptibility of lettuce to mosaic virus infection in relation to soil conditions has already been noted from another source [ibid., xxiv, p. 351]. An investigation into the relation between watering frequency and the effect of mosaic on tomato plants showed that, with the possible exception of the Potentate variety at the medium water-level, there is little sign of any interaction between infection and watering frequency as affecting fruit yield.

Selman discusses the difficulty of safeguarding tomato crops from spotted wilt virus while growers of arum lilies, dahlias, and chrysanthemums are reluctant to destroy these plants when infected with the virus as long as they are able to produce normal blooms. Growers are recommended to select undiseased stocks for propagation and to fumigate regularly old, and possibly diseased stocks, with nicotine shreds (2 oz. per 1,000 cu. ft.) to kill the thrips insect vector.

O. Owen describes three types of magnesium deficiency in tomatoes. That due to the physiological strain on plants when 4 to 5 ft. high and carrying a heavy crop is manifested by downward curling of the leaf and the development of yellow interveinal areas, while the veins remain dark green and sometimes the margins remain green; a rare effect is a thinning and grey-green discoloration of the tip, continuance of which may cause setting failure in the trusses then forming. A high soil potash content tends to induce magnesium deficiency and a timely application of a rich dressing of nitrogen is advocated to remedy this condition. Deficiency due to unsuitable physical conditions in the subsoil can be remedied by improved drainage of the subsoil. This type usually depresses yield and often promotes senescence and early death in batches of plants in a house or block of houses. Magnesium deficiency in tomatoes grown on sandy soils is often attributed to high potash dressings, thereby reducing the magnesium status, but the author considers that nitrogen deficiency or some other subsoil factor is a more likely cause. Growers are recommended to dissolve 20 lb. Epsom salts [magnesium sulphate] in 100 gals. water with a wetter and to spray the leaves with a 2 per cent.

solution. Sulphonated lorol at 8 oz. or agral at 6 fluid oz. per 100 gals. proved effective wetters. In serious cases spraying should begin from 8 to 10 weeks after planting, with repetitions every fortnight.

New plant diseases.—*Agric. Gaz. N.S.W.*, lvii, 1, pp. 25–26, 1946.

Included in this list of 36 plant diseases in New South Wales newly recorded during the nineteen months ended 30th November, 1945, are the following: root rot of *Chrysanthemum* (*Macrophomina phaseoli*), leaf spots of parsnip (*Ramularia pastinacae* and *Cercosporella pastinacae*), neck [dry] rot of *Gladiolus*, mango powdery mildew (*Oidium* sp.), and collar rot of French marigold (*Tagetes* sp.) due to *Phytophthora cryptogea*.

Fields (W. S.). **Summary of the more important plant diseases taken in connection with the insect and plant disease survey in the general vicinity of the ports of entry from January 1945 to June 30, 1945.**—*Plant Dis. Reptr*, xxix, 11, pp. 693–697, 1945. [Mimeographed.]

This list of 93 fungi and viruses observed in the vicinity of the United States ports of entry during the period January to 30th June, 1945, includes the following species believed not to have been reported previously in that country: *Ascochyta caricae* Rab., causing large leaf spots on figs [*R.A.M.*, ix, p. 227] in Oregon; *Heterosporium betae* on *Beta vulgaris macrorhiza*; *Taphrina bullata* [ibid., iii, p. 724; viii, p. 111] on pear in Washington in 1944; and pea enation virus on *Melilotus* in California [ibid., xiv, p. 486] in 1943. In addition *A. nicotianae* on tobacco in Washington is suspected of being a new record [cf. ibid., v, p. 599]; *Botryosphaeria ribis* on *Taxus baccata fastigiata* in Philadelphia, a new host record; *Oidium mangiferae* on mango in California in 1944, believed to be first report for California and the western United States.

Riker (A. J.), Spoerl (E.), & Gutsche (Alice E.). **Some comparisons of bacterial plant galls and of their causal agents.**—*Bot. Rev.*, xii, 2, pp. 57–82, 1946.

Most of the more recent literature reviewed in this comparative survey of bacterial plant galls and their agents has already been noticed from the original sources. The present paper includes synoptic tables showing (1) the causal organisms and prominent hosts of nine diseases of this type, namely, beet pocket rot (*Phytomonas* [*Bacterium*] *beticola*) [*R.A.M.*, viii, p. 148], cane gall (*P.* [*Pseudomonas*] *rubi*) [ibid., xx, p. 374], crown gall (*Phytomonas* [*Bact.*] *tumefaciens*) on a very wide host range, especially among the Rosaceae, Douglas fir (*Pseudotsuga taxifolia*) gall (*Phytomonas* [*Bact.*] *pseudotsugae*) [ibid., xvi, p. 719], *Gypsophila* gall (*P.* [*Bact.*] *gypsophilae*) [ibid., xiii, p. 772], hairy root (*P.* [*Bact.*] *rhizogenes*) on apple and rose [ibid., x, p. 166], oleander knot (*P. tonelliana*) [*Pseudomonas savastanoi* var. *nerii*: ibid., vii, p. 725], olive knot (*Phytomonas* [*Pseudomonas*] *savastanoi*) [ibid., ii, p. 12], and pea fasciation (*Phytomonas* [*Corynebacterium*] *fascians*) [ibid., xvi, p. 102; xxi, p. 365]; (2) the differential characters of the nine bacteria inducing cell proliferation; and (3) some critical points in the life-histories of the same organisms in relation to their pathogenesis. The bibliography comprises 59 titles.

Starr (M. P.). **The nutrition of phytopathogenic bacteria. I. Minimal nutritive requirements of the genus Xanthomonas.**—*J. Bact.*, li, 2, pp. 131–143, 3 graphs, 1946.

The minimal nutritive requirements of 113 isolates of phytopathogenic bacteria representing 30 species and varieties of *Xanthomonas* [cf. *R.A.M.*, xxii, p. 344] were determined under conditions of controlled inoculum, carefully cleaned glass-

ware, and pure medium components. Most of the species were found to be capable of a certain amount of growth on the simplest substratum used, viz., sodium chloride, glucose, and salts, among those thriving best on this diet being *X. barbareae*, *X. begoniae*, *X. campestris* var. *armoraciae*, *X. carotae*, *X. corylina*, *X. cucurbitae*, *X. geranii*, *X. incanae*, *X. juglandis*, *X. lespedezae*, *X. maculafoliagardeniae*, *X. malvacearum*, *X. manihotis*, *X. papavericola*, *X. vasculorum*, and *X. vesicatoria* var. *raphanae*. Of the more exacting species, *X. hederae*, *X. translucens* f. sp. *cerealis*, f. sp. *hordei*, f. sp. *hordei-avenae*, and f. sp. *undulosa* responded favourably to the stimulus of *dl*-glutamic acid (0·1 per cent.) and *dl*-methionine (0·02 per cent.) in combination or the latter alone. The growth of *X. phaseoli* var. *fuscans* was promoted by both supplements together and to a moderate extent by glutamic acid alone. *X. pruni* failed to develop in any of the media tested except casein hydrolysate with the addition of nicotinic acid.

Stapp (C.). **Der Pflanzenkrebs und sein Erreger Pseudomonas tumefaciens. XIII. Mitteilung. Über die Bedeutung des Colchicins als polyploidisierendes Mittel für den Erreger und als angebliches Bekämpfungsmittel gegen den Wurzelkropf.** [Crown gall of plants and its agent *Pseudomonas tumefaciens*. Note XIII. On the significance of colchicin as a means of inducing polyploidization in the agent and as a reputed method of crown gall control.]—*Zbl. Bakt.*, Abt. 2, cvi, 16–19, pp. 338–350, 5 figs., 1944. [Received May, 1946.]

Negative results were given by experiments on the polyploidization of the *Dahlia* and *Chrysanthemum frutescens* strains of *Pseudomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xxiii, p. 335] by the admixture with the iron-manganese-carrot extract medium of 0·1 to 0·2 per cent. colchicin [ibid., xviii, p. 445]. Attempts at the cure of crown gall in naturally infected apple and pear seedlings and inoculated *Datura tatula* and *Pelargonium zonale* by the application of a 2 per cent. colchicin solution were similarly unsuccessful.

Buvat (R.). **Recherches sur la dédifférenciation des cellules végétales. II. Cultures de tissus et tumeurs.** [Researches on the dedifferentiation of plant cells. II. Cultures of tissues and tumours.]—*Ann. Sci. nat.*, *Bot.*, Sér. xi, vi, pp. 1–119, 19 pl. (7 col.), 39 figs., 1945.

In the section of this exhaustive study on the dedifferentiation of plant cells that deals with cortical tumours produced by artificial inoculations of pieces of tomato stem with a culture of *Phytomonas* [*Bacterium*] *tumefaciens*, the author concludes that the proliferations produced by this organism are not comparable with animal cancers [cf. *R.A.M.*, xxii, p. 13], on the grounds that the young proliferating cells in the tumour are all diploid, tetraploid cells being found only in a few large cells in old tumours, and that the growth gradually slows down in time.

Posnette (A. F.). **Cacao virus research in West Africa.**—*Rep. Cocoa Res. Conf.*, *1945*, pp. 114–117, 1945.

In the Eastern Province of the Gold Coast, cacao swollen shoot [*R.A.M.*, xxv, p. 253] is extending its area of heavy infection, especially to the west of Suhum, where more and more farms are being completely destroyed by the disease. Observations on one farm near Mangoase showed that from 1939 to 1944, swollen shoot killed 74 per cent. of 30–40-year-old and 43 per cent. of the 20–30-year-old trees. The total production fell from 30 tons per annum in 1926–29 to 20 tons in 1936–39, and to only six tons in the last two seasons.

The extension is recorded of cacao viruses into Nigeria, where several outbreaks have occurred in the Ibadan district. The leaf symptoms in Nigeria often resembled

those noticed in Venezuela more closely than those of the Gold Coast. This, with the presence of cacao viruses in Trinidad [ibid., xxiii, p. 379], suggests that cacao virus diseases may occur wherever the crop has been widely cultivated for 30 years or more.

Estimations of the rate at which swollen shoot spreads were based on figures from five different localities and showed that outbreaks increased threefold in three years, 11 times in five years, and 88 times in seven years.

The effectiveness of roguing as a means of control was established under two different sets of conditions. At Tafo, monthly inspections, followed by the prompt removal of affected trees, have checked tree-to-tree spread and also kept fairly constant both the number of new outbreaks and the number of diseased trees during the past three years. In the years 1939 to 1944 there were, respectively, 10, 17, 14, 40, 47, and 41 outbreaks and the numbers of infected trees destroyed were 55, 347, 189, 104, 150, and 185. The large-scale extension of roguing to native farms has also been generally effective; for example, near Nkawkaw, an area of 70 acres was treated in 1942, and showed only 15 diseased trees in November, 1944.

Devastated farms have been replanted on a large scale with at least temporary success, and if farmers can be persuaded to remove the infected trees beforehand the results will be more lasting. When the trees reach bearing age, swollen shoot spreads more rapidly; hence, if control is not practised, the productive life of the new farms will probably be brief. If roguing were regularly practised it is possible that production would soon become profitable again in the areas at present devastated.

Swollen shoot can be caused by any one of a complex of viruses. Cross-immunity tests indicated that strains A (New Juaben) and B (Bisa) may be related, while C (Kpeve) may be outside the swollen shoot complex. It would seem that the viruses may fall into two groups, distinguished by their symptoms and probably by their vectors. H. E. Box [ibid., xxiv, p. 307] has transmitted strains A and B, characterized by prominent swellings, by means of the *Pseudococcus exitiabilis* group. He failed to transmit A and B with *P. citri*, with which, however, he transmitted C and D (Nkawkaw), characterized by very small swellings or the absence of swellings, and a red mottle on the young leaves.

Other work on these viruses showed that strain A gives a positive and C a negative staining reaction in the acidified methyl alcohol test. In graft transmissions, A and C moved from scion to stock at approximately the same speed. Neither A nor B was inactivated in budwood after 40 minutes' immersion in water at 50° C. Strains A, B, and C gave no evidence of seed transmission. Chlorosis and stunting of seedlings from trees affected with A appears to be a physiological effect, these seedlings failing to transmit the virus when grafted to healthy seedlings. No transmission of A occurred when healthy trees were pollinated by infected trees.

It was found that at least a year's infection with the mild strain B is required to produce any immunity from A, and that even then the result is unpredictable for any particular tree.

In the search for resistant cacao plants, no plant has been found to be immune, or resistant to primary infection by grafting. Several were either tolerant of the virulent strain A or immunized against it by the presence of a presumed attenuated strain. A mild virus resembling A in leaf symptoms is now frequently observed in young cacao planted where the original trees were killed. Whatever the explanation may be, clones now exist which are almost symptomless except immediately after propagation by budding, when the first flush of scion growth shows typical mosaic; later growth presents no symptoms. Such plants are not, as a rule, affected by reinfection with A.

ALIBERT (H.). **Note préliminaire sur une nouvelle maladie du Cacaoyer, le 'swollen shoot'.** [Preliminary note on a new Cacao disease, 'swollen shoot'.]—*Agron. trop.* (formerly *Agron. colon.*), i, 1–2, pp. 34–43, 4 figs., 1 map, 1946.

In connexion with the discovery of cacao swollen shoot in Abengourou, Grand-Bassam, Agboville, and Daloa regions of the Ivory Coast [see next abstract], where a survey for the disease was instituted in December, 1943, the writer summarizes the available information, chiefly based on investigations in the Gold Coast [see preceding abstract], on its history, symptomatology, life-cycle of the virus, modes of transmission (grafting and insect vectors), propagation of the disease, damage (in the Gold Coast), distribution in the Ivory Coast (shown by the aid of a useful map), control by (*a*) eradication and burning of diseased trees and (*b*) isolation of resistant varieties, and a staining test, devised at the Institut Pasteur, Paris, for the early diagnosis of infection (before the development of external symptoms). In the Ivory Coast the disease assumes various degrees of severity, including the virulent New Juaben form. With a view to the selection of resistant individuals, small plantations of young trees are to be laid down for observation in the Man district at an altitude ranging from 200 to 1,000 m.

MANGENOT (G.), ALIBERT (H.), & BASSET (A.). **Sur les lésions caractéristiques du swollen shoot en Côte d'Ivoire.** [On the characteristic swollen shoot lesions in the Ivory Coast.]—*C.R. Acad. Sci., Paris*, ccxxii, 13, pp. 749–751, 1946.

Cacao swollen shoot in the eastern regions of the Ivory Coast [see preceding abstract] is characterized in a general way by swellings on the shoots, the preferred sites of which are the young lignified branches, especially the suckers. The leaves of diseased trees tend to be stunted, and some of them bear mottled lesions varying in type in different localities.

In the plantations of Sankadiokro and Apompromou, the creamy-white spots, contrasting vividly with the basic green of the leaf, are very variably distributed, consisting either of plaques of differing size, sometimes confluent, scattered between the secondary veins, or more often of irregular bands distributed at random among the primary and secondary veins, from which they are frequently divided by a strip of green. The network of veins in the area covered by the lesions often presents malformations, apparently caused by contraction during growth, and leads to leaf curvature.

In the Kongodia region the lesions are definitely yellow and generally more diffused than those of the foregoing type, developing between the veins in the form of a sprinkling of numerous small spots, often merging to cover the entire area traversed by several secondary veins, the zones in immediate contact with which, as in the Sankadiokro plantations, tend to remain green. A brownish cast, especially noticeable on the under side, extends over both the green and the yellow areas. The malformations are much less prominent than in the preceding case.

The white lesions, examined microscopically *in vivo*, present translucent plaques, while the air-spaces between the mesophyll cells, so conspicuous in normal leaves, appear to be entirely absent. The chloroplasts are well-differentiated, very minute, ovoid, and semi-colourless, elaborating no starch; in an abnormally siderophile cytoplasm the nucleus may present indications of pycnosis (Feulgen's method). The tannoids are much more abundant than in the normal areas of the leaf, the fibrous sheaths of the more or less atrophied cribrovascular bundles being full of them.

On the other hand, the yellow lesions are never translucent *in vivo*, and the intercellular spaces are occupied, as in normal foliage, by air. The lacunar tissue, however, is more dense than in the healthy parts of the leaf, the lacunae being reduced to narrow slits between the cells or even occasionally absent. The cells are occupied by chloroplasts with an abnormally thin cortex enclosing a grain of

starch; the cytoplasm and nucleus present no exceptional feature. There is, however, hypersecretion of tannins, which in the lower epidermis are often brown.

WHITTAKER (A.). **The Cocoa and Chocolate (War Time) Association.**—*Rep. Cocoa Res. Conf., 1945*, pp. 152–153, 1 map, 1945.

This paper is accompanied by a folding sketch-map (scale 20 miles = 1 in.) showing the spread of cacao swollen shoot [see preceding abstract] in the Gold Coast since 1936.

THOROLD (C. A.). **Cacao diseases in Trinidad.**—*Rep. Cocoa Res. Conf., 1945*, pp. 140–141, 1945.

The incidence of cacao witches' broom [*Marasmius perniciosus*: *R.A.M.*, xxiv, pp. 52, 140] in Trinidad has not changed much in the last few years. It is less severe in certain areas where it has long been present. A few new areas of infection have developed in Tobago, while in Trinidad the disease has become severe in some parts where it was previously unimportant, e.g., at River Estate.

The occurrence of a cacao virus disease in Trinidad has been observed by Posnette [ibid., xxiii, p. 379]. It is confined to the western end of the Northern Range, and does not seem to be of economic importance.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, lvii, 3, pp. 125–129, 6 figs., 1946.

Notes are given on seed treatment against wheat bunt [*Tilletia caries*], loose smut of wheat [*Ustilago tritici*], oat smuts (*U. avenae* and *U. levis* [*U. kolleri*]), and barley smuts [*U. nuda* and *U. hordei*]. The Lampton variety of oats is stated to be highly resistant to smut; Belar, Buddah, Gidgee, Mulga, and Sunrise moderately resistant; and Algerian, Burke, Fulghum, and White Tartarian susceptible.

Symposium of seed-borne diseases.—*Proc. Canad. phytopath. Soc.*, xii, pp. 18–21, 1944.

F. J. GREANEY states that during the four-year period 1939–43, over 4,000 samples of wheat, oat, and barley seed from all parts of Canada were examined for the presence of disease. While most of the wheat seed carried spores of bunt [*Tilletia caries* and *T. foetida*], only a few bore a spore load of one part or more to 128,000 parts of seed, by weight, and so required treatment. A relatively large proportion, however, of the oat and barley samples were in need of treatment against smut [*Ustilago avenae* and *U. kolleri* on oats and *U. nuda* and *U. hordei* on barley]. Plating tests showed that the most important pathogens present were *Helminthosporium sativum* on wheat and barley, *H. avenae* [*Pyrenophora avenae*] on oats, and *H. teres* on barley. The results of the survey indicate that seed treatment and every other means available should be employed to prevent the inter-regional distribution of pathogenic seed-borne organisms in Canada.

According to P. M. SIMMONDS, some 18,000,000 bush. wheat seed were sown in Saskatchewan during 1944, while the acreage sown to oats and barley, though smaller, involved the handling of millions of bushels of seed. All seed should be either disease-free or treated for disease control. As Thatcher wheat, which is rather susceptible to bunt, has replaced the resistant Marquis variety in popularity, the possibility of an increase in bunt infection locally has to be borne in mind. At present, bunt is not readily found in most fields and farmers now tend to omit seed treatment. An annual seed examination service would give a complete view of the seed question, on which future work could be based. In Saskatchewan one privately owned laboratory offers to carry out a seed examination service for a small fee, and its work appears to be reliable. This type of service should be extended and controlled by Government regulations.

H. W. Mead describes various types of automatic and power-driven seed-treating machines, together with home-made models, and it has also been demonstrated that seed-grain can be dusted efficiently with a shovel. Tests with wheat, oat, barley, and flax seed demonstrated that the Kemp Model 40 automatic treater, and the same fitted with elevator and bagger, applied dust to 99 per cent. of the seed and gave an even coverage. The Roto-Grav automatic machine covered over 90 per cent. but coverage was uneven. The Minnesota treater gave 78 per cent. coverage, uneven. With the shovel method, 76, 86, and 100 per cent. of the seeds were covered on the first, third, and fourth mixes, respectively.

A. J. Skolko presents some examples from tests made at Ottawa, illustrating the danger involved in importing diseased pea seed, the present status of examinations of imported vegetable seed from the United States, and the effect of flax retting on the amount of seed cracking.

A. A. Hildebrand points out that soy-beans are susceptible to at least 32 parasitic diseases, and states that 11 of a reported total of 13 seed-borne diseases of this host occur in Canada. Mosaic, pod and stem blight [*Diaporthe phaseolorum* var. *sojae*: *R.A.M.*, xxiv, p. 264], and anthracnose [*Glomerella glycines*: ibid., xxii, p. 463] are not amenable to control by surface disinfectants, but control by seed treatment of downy mildew [*Peronospora manshurica*: ibid., xxv, p. 264] and brown spot [*Septoria glycines*: ibid., xxii, p. 463] can, apparently, be highly effective. Recent experiments showed that treatment of mildewed seed of the variety A. K. Harrow with spergon and arasan not only increased emergence by over 10 per cent., but reduced post-emergence diseases in the seedlings. In other circumstances spergon was more effective than either arasan or fermate. For instance, when composite samples of 1942 A. K. Harrow commercial seed of low viability and high disease potentiality were treated with spergon, arasan, and fermate at 2, $1\frac{1}{2}$, and 2 oz. per bush., respectively, percentage emergence was, respectively, 224·7, 87·3, and 77 (untreated control, 100), while percentage incidence of post-emergent disease in the seedlings was, control 22·2, spergon 14·9, arasan 22·5, and fermate 21·6.

Irene Mounce and J. E. Bosher give notes on soil tests and seed treatments in relation to vegetable diseases. J. Walton Groves reports on a number of fungi not previously recorded as seed-borne. T. C. Vanterpool states that the most serious flax disease in Saskatchewan is stem-break and browning (*Polyspora lini*) [ibid., xxiv, p. 506]. Not uncommonly, 30 to 40 per cent. of the flax-seed samples examined in any one year are infected by this fungus, most of the samples also showing a high percentage of seed-cracking [ibid., xxiv, p. 507]. Seed disinfection with new improved ceresan counteracts the harmful effects of cracking, but does not completely prevent *P. lini* from appearing in the crop.

Report of the Milling and Baking Meeting and Seventh Hard Spring Wheat Conference, 1944.—55 pp. [? 1944. Mimeographed. Received 1946.]

The section of this report concerned with diseases in relation to wheat-breeding in the United States (pp. 24–41) contains a discussion by M. N. Levine on the relation of leaf [brown] rust (*Puccinia rubigo-vera tritici*) [*P. triticina*] to spring wheat improvement. The results of large-scale, co-operative varietal tests in the nursery and field from 1940 to 1943, inclusive, showed that none of the six varieties selected for comparative studies maintained even a moderate degree of resistance under all conditions, the infection maxima in the uniform nurseries being 45 per cent. for Merit in Arkansas in 1941, 60 per cent. for Newthatch in Kansas in 1943, 95 per cent. for Pilot in Virginia in 1940, 80 per cent. for Regent in Arkansas in 1941, 90 per cent. for Renown in Virginia in 1941, and 75 per cent. for Rival in Indiana in 1940. In the field Merit sustained the maximum damage of 25 per cent. in North Dakota in 1941, Newthatch and Pilot 33 and 40 per cent., respectively, in Minnesota in 1943, Regent and Renown 28 and 55 per cent., respectively, in Nebraska in 1943,

and Rival 50 per cent. in Minnesota in 1941. During the past 20 years, 299 cultures of the rust were obtained from the four States comprising the spring wheat region, namely, Minnesota, North and South Dakota, and Montana. They fell into 39 different physiologic races [*R.A.M.*, xxiii, p. 58 *et passim*], of which the three most common were 9, 15, and 5, representing, respectively, 20·4, 10, and 5 per cent. of the total, while others requiring notice include 49 (becoming increasingly prevalent since 1941), 13, 19, 28, 31, and possibly 126. So far race 9 is the only one to have been collected in all four States, while 13 and 50 occurred in all except South Dakota. In addition to the standard differential varieties used for physiologic race identification, another 30 or so are to be included in forthcoming trials of material from the northern tier of States, among them being, besides the above-mentioned six, Henry, Mida, Timopheevi × Steinwedel, and two new durums Carleton and Stewart. The complete susceptibility in 1943 of Timopheevi × Steinwedel to races 12, 61, and 107 was surprising as hitherto the crop had been uniformly extremely resistant. Plans for future breeding for resistance to stem [black] rust [*P. graminis*] must, in E. C. STAKMAN's view, be based on information concerning (1) races which have occurred in the past, (2) their geographical distribution, (3) the population trends over a period of years, (4) the introduction of new races or recurrence of old ones, and (5) the behaviour of the former on the new varieties they are likely to encounter. Racial recognition may be limited by the paucity of differential varieties, more of which are now required to yield the necessary information. Race 15 B, for instance, is distinguishable from the original 15 by its effects on Rival. The importance of barberry eradication as a precaution against the dissemination of new races may be gathered by the fact that a different race occurs roughly once in five isolates from collections taken near these bushes, compared with once in 50 from material originating at a distance from the alternate host.

W. Q. LOEGERING's greenhouse inoculations of many old and new wheat varieties with up to 40 different physiologic races of *P. graminis* are intended to provide guidance as to the probable field reactions of such varieties to the rust, and to assist in the discovery of breeding material with constitutional resistance to races like 15 B [ibid., xxiv, p. 142]. Red Egyptian Na 101, and K 117 have been found to possess a measure of resistance to the race in question.

HELEN HART's tests with ten races of *P. graminis* on 40 new hybrid wheat varieties, extending from 1939 to 1943 and involving the inducement of artificial epidemics of black rust, have already been noticed from another source [ibid., xxiv, p. 141].

E. R. AUSEMUS carried out a series of greenhouse tests to determine the seedling reactions of certain wheat varieties to a number of prevalent physiologic races of *P. graminis*, which disclosed new sources of resistance in five Kenya selections (notably Minn. 2693 and 2694), McMurachy, Kenya-Gular, and *T[riticum] timopheevi* Steinwedel. These lines were crossed with certain varieties possessed of moderate to high field resistance, but the data on the resultant hybrid progeny indicate that the factors controlling the latter type of resistance are not allelic, since susceptible plants arose in the F_2 and later generations. Two Kenya spring wheats are highly resistant to race 15 B and Red Egyptian moderately so. H. A. RODENHISER briefly summarizes the results of varietal tests and bunt [*Tilletia caries* and *T. foetida*] physiologic race surveys [ibid., xxv, p. 209], and R. W. SMITH describes bunt resistance studies in North Dakota, in which specially promising results were given by (Hope–Ridit × Reward) × (Komar–Hussar × Hope–Rel[iance]) and Komar–Hussar × (Hope–Ridit × Reward), both in the F_6, and Nos. 1563 Hope × Turkey–Florence and 1552 Ceres × Pilot, the last-named being a heavy cropper and incidentally resistant to rust [*Puccinia* spp.]. R. H. BAMBERG contributes a short discussion of the dwarf bunt [*T. caries*] problem in western Montana and other western States [ibid., xxii, p. 472], where the disease may

cause yield reductions of 75 per cent. The cultivation of three resistant varieties, Relief, Cache [ibid., xxiii, p. 381], and Ridit × Relief, of which the first two had already been released and the third was in an advanced stage of testing at the time of writing, should assist in the control of infection.

R. Sprague reviews the root-rot situation in the hard red spring wheat region, where *Helminthosporium sativum*, *Pythium arrhenomanes*, and *Rhizoctonia* [*Corticium*] *solani* are the chief organisms implicated in the disease complex. The new Mida variety is reasonably tolerant of root rot in central and western North Dakota.

In studies by E. R. Ausemus the maximum resistance to scab (*Gibberella zeae*), both in the field and under tents at the Minnesota Agricultural Experiment Station [ibid., xxiii, p. 478] in experiments from 1933 to 1943 was shown by the Haynes Bluestem and Progress varieties, while a measure of field resistance was characteristic of Rival, Pilot, Hope, Merit, Vesta, and Mercury. Analysis of correlation co-efficients for scab in the field and seed reaction showed moisture and temperature to be of greater importance in the development of infection than the genetic factors controlling reaction to the pathogen. Stem [black] and leaf [brown] rust [*P. graminis* and *P. triticina*] reactions and awnedness were studied in the F_3 lines. Response to black rust in field plants appeared to depend on two or three factor pairs and the other characters on single factor pairs. The sole indication of linkage was between field scab and brown rust reaction in the Rival × Bluestem and H-44-Thatcher × Bluestem crosses.

Between 1930 and 1936, about 250 varieties and hybrid selections were tested by R. G. Shands for scab resistance for one to five years under conditions of high humidity at the Wisconsin Agricultural Experiment Station in comparison with Progress and Marquis, the average incidence of infection in which over the experimental period was 56·6 and 72·5 per cent., respectively. None of the varieties or selections tested contracted significantly less scab than Progress, though among those showing resistance were selections of Illinois No. 1, Haynes Bluestem, Preston, Java, Kearney County Java, Albidum 0721, and several Russian varieties. It may be of interest to note that some of the more resistant lines, including the two Javanese, Progress, and Illinois No. 1 selections, are derived from the Java type which is of Chinese origin, and in this connexion the exploration of the Amur River and Manchuria for resistant types is suggested, the disease having historical importance in that area. Another approach might be made through Denmark, Sweden, and Switzerland, where scab-resistant barleys have been found.

Surveys conducted by E. W. Hanson and J. J. Christensen in 1942 revealed fungal infection in 98 per cent. of all the wheat produced in Minnesota, a relatively high proportion being caused by *Helminthosporium* and *Fusarium* spp. The incidence of seed discoloration ('black point') [associated with *H. sativum* and other fungi] ranged from 1 to 73 per cent., durums being in general much more susceptible than bread varieties; Kubanka [ibid., xxiii, p. 130] sustained the maximum amount of damage in the former and Rival in the latter group. Seed treatment of several varieties with semesan jr. in six localities in 1942 resulted in average stand increases of 8 to 41 per cent. and average reductions in seedling blight of 46 to 83 per cent.

E. W. Hanson presents a table showing the reactions of 19 common spring, five durum, and two winter wheats to a number of diseases, including [unspecified] root and foot rots, from which it appears that the durums are more susceptible to this pathological complex than most of bread varieties, with the exception of Marquillo and Ceres.

Report of the Fifth Hard Red Winter Wheat Improvement Conference, 1945.—63 pp., 1945. [Mimeographed.]

This report includes a number of contributions (pp. 24–32) to the breeding of hard red winter wheat for resistance to various diseases affecting the output of the

crop in the United States [see preceding abstract]. Some of the items have already been noticed from other sources, but attention may be drawn to the following. The most extensive programmes for the development of stem [black] rust [*Puccinia graminis*] resistance are stated by C. O. JOHNSTON to be in operation at Denton, Texas, Manhattan, Kansas, and Lincoln, Nebraska. At these and other co-operating experiment stations combined resistance to stem and leaf [brown] rust [*P. triticina*] is sought, and in many crosses a similar reaction to bunt [*Tilletia caries* and *T. foetida*], loose smut [*Ustilago tritici*], and Hessian fly [*Phytophaga destructor*] is also an objective [*R.A.M.*, xx, p. 107]. Large numbers of strains resistant to both rusts have been developed, among the most promising being two selections of Mediterranean–Hope × Pawnee, which outyielded all the rest in the 1944 rod-row tests.

Hybrid material should be thoroughly tested with the most important physiologic races of the two rusts occurring in the hard red spring wheat area, viz., 9, 15, 44 [ibid., xxv, p. 104], and 126 of *P. triticina* and 56, 17, and 38 of *P. graminis*. The heavier infection of resistant varieties by brown rust in 1944 is thought to be at least partially attributable to the increase in prevalence of races 15 and 126.

Brown necrosis is a problem in the selection of black rust-resistant strains from the progeny of crosses in which Hope or H-44 serve as parents. Light or moderate amounts of the defect do not appear to reduce yields, and some apparently stable selections satisfying the necessary requirements have been made.

K. S. CHESTER describes one of the principal aims of the Oklahoma wheat-breeding project as the combination of resistance to brown rust, the most destructive disease in the State, with other desirable agronomic characters. The best ten out of 700 selections in the F_6 to F_8 from segregating hybrid lines were increased in 1944–5; they were the offspring of compound crosses in which the progenitors were Oro, Tenmarq, Hope, Cheyenne, Hussar, Mediterranean, Nebred, Kanred, Kawvale, and H-44, and united resistance to both rusts with heavy cropping, earliness, stiff straw, grain quality, and the like.

E. S. MCFADDEN states that, of some 2,000 foreign wheat introductions tested in the field at College Station, Texas, during the last eight years, 43 varieties have been found with differing degrees of resistance to *P. graminis*, combined in some cases with a similar response to *P. triticina*.

During the period from 1924 to 44, inclusive, according to M. E. YOUNT, the formerly predominant physiologic races of black rust, 3, 10, 11, 18, 21, 32, 36, 39, and 49, have virtually disappeared from Nebraska, being replaced by 56, 38, and 17. The average number of races occurring annually has declined by roughly 31 per cent., coinciding with a 62 per cent. increase in the number of isolations determined. Even more encouraging is the fact that only two or three races have been present in more than trace amounts of recent years.

I. M. ATKINS reports an estimated annual loss from loose smut during the eight-year period from 1935 of 2,577,000 bush. wheat in Texas, Oklahoma, Kansas, and Nebraska, where the hard winter crop is mainly grown. Of 275 varieties and strains tested for their reactions to *U. tritici* in Texas, Kansas, and Illinois, the soft wheats, Kawvale, Currell, Trumbull, and Leap, showed the maximum degree of resistance. Pawnee is the only hard red winter wheat that has proved highly resistant to loose smut after adequate testing, though a fair degree of resistance has been shown by Hope × Turkey, which reacts similarly to black and brown rusts. In addition to the above-mentioned highly resistant varieties, Newturk, Yogo, and Hope × Mediterranean should provide valuable material for use as parents in crossing experiments.

Varietal reaction differed markedly at the three stations. For instance, the soft Early Premium, Purplestraw, Gasta, Gladden, Forward, Fulhio, and Zimmerman were highly susceptible in Illinois, moderately to slightly so in Kansas, and resistant throughout the experimental period in Texas, whereas Denton, Mediterranean, and

Fultz were highly susceptible in Texas but showed little infection at the other two locations; Gipsy, Minhardi, and Valley contracted the disease in a severe form in Kansas but were not appreciably damaged elsewhere. These observations emphasize the risk of sending infected seed from one part of the country to another.

Among the wheat varieties most resistant to speckled leaf blotch (*Septoria tritici*) in Kansas [ibid., xxiv, p. 12] H. Fellows found Red Chief, Ukraine, Wisconsin Pedigree No. 2, Brill, Mediterranean, Valley, Jenkin, Triplet, Yorkwin, and Minhardi, followed by Sibley 81, Bald Rock, Denton, Nabob, Gladden, Prairie, Thorne, and Illinois, while promising hybrid combinations included Gelow × Oro F_7, Clarkan × Eureka F_3, *Triticum vulgare–T. timopheevi* × *T. vulgare*, Marquillo–Oro × Hope–Kawvale, and Marquillo × Oro F_{12}.

Four new recommended Wheats which combine stem rust resistance with yield and quality.—*Agric. Gaz. N.S.W.*, lvii, 1, pp. 3–6, 4 figs., 1946.

Of these four new wheats recommended for sowing the wheat areas of New South Wales, Gabo (a Bobin selection × Gaza × Bobin selection) is remarkably resistant to the known races of stem [black] and leaf [brown] rusts [*Puccinia graminis* and *P. triticina*]; it is an early variety, for which late sowing is recommended to counteract its moderate susceptibility to flag smut [*Urocystis tritici*]. Kendee (Dundee × Kenya (U.A. No. 745)), suitable for mid-season planting in the north-western areas, is resistant to black rust and flag smut, but susceptible to brown rust. Yalta (Kenya × Pusa 4 × Dundee), a main-crop variety, shows considerable resistance to black rust, average susceptibility to brown rust, and high resistance to flag smut. Celebration (Double Cross × Dundee × Dundee), a late-maturing main crop variety, resists flag smut and black rust vigorously. [Notes on other recommended wheat varieties are given on pp. 10–11.]

Hansing (E. D.) & Melchers (L. E.). **Further studies on the occurrence and distribution of physiologic races of Tilletia foetida in Kansas.**—*Trans. Kans. Acad. Sci.*, xlviii, 1, pp. 71–77, 1 fig., 1945.

The differential wheat varieties, Chiefkan, Ridit, Oro, Hussar, White Odessa, and Canus, were inoculated with 100 collections of *Tilletia foetida* from 57 counties of Kansas to determine the number, prevalence, and distribution of physiologic races in the State [*R.A.M.*, xxi, pp. 284, 329]. Of these, 82 were classified as L-3, one as L-4, seven as L-5, and ten as L-7.

Glynne (Mary D.), Dion (W[endy] M.), & Weil (J. W.). **The effect of eyespot (Cercosporella herpotrichoides Fron) on Wheat and the influence of nitrogen on the disease.**—*Ann. appl. Biol.*, xxxii, 4, pp. 297–303, 1 pl., 6 graphs, 1945.

With a view to determining how the considerable reduction in the yield of wheat due to *Cercosporella herpotrichoides* [*R.A.M.*, xxiv, p. 183] is caused, the effect of eyespot throughout the season on wheat receiving different amounts of nitrogen was studied in pot experiments.

The close study of pot plants at short intervals confirmed many general impressions obtained from field observations. Plants inoculated in December showed chlorosis of the outer leaves in February followed by the death of many plants; straggling, whiteheads, delay in flowering and in growth, reduction in final height and a more uneven crop, reduction in yield of straw and a greater reduction in that of grain were observed among the survivors. The application of nitrogen reduced, and in some cases, eliminated, these adverse effects.

In comparing these results with those in the field it should be remembered that the effect of the disease in pots is likely to be greater than in the field.

In the uninoculated, high-nitrogen series of pot experiments, the yield of grain amounted to 27 cwt. per acre and in the low-nitrogen inoculated pots only to about

9 cwt. per acre. These results, and the quality of grain, as shown by the percentage of tail corn, were similar to those obtained from moderate crops in the field. In the case of the inoculated low-nitrogen series, however, the percentage of tail corn was so high that the loss of dressed corn was considerably greater than that estimated from total weight.

In the field applications of nitrogen were found to have two opposing effects on eyespot. The more luxuriant crops maintain a damper atmosphere near soil-level, which favours the spread and development of the disease. At the same time, the increased tiller production resulting from the application of nitrogen appears to enable the plant to discard the most severely diseased tillers and so reduces the intensity of the infection at harvest. These considerations, necessitating further study, are thought to account for the discrepancy in field observations in the past, notably of Sprague and Fellows [ibid., xiv, p. 230], Hoffman [ibid., xiv, p. 229], Weigert and Weizel [ibid., xiv, p. 351], Oort [ibid., xvi, p. 29], and Meijers (*Versl. LandbDir.*, *'s Grav.*, xliii, (8) A, pp. 271–311.

Field records and pot experiments show that the effect of nitrogen in increasing yield and reducing the damage done by eyespot considerably outweighs its ill effects in increasing the spread of the disease. Its application to infected crops appears to be particularly desirable, provided that general lodging of the crop is not induced, a probability which, as distinct from straggling, can be reduced by using short, strong-strawed varieties.

Klotz (L. J.) & Middleton (J. T.). **Copper spray damage to Citrus.**—*Citrus Leaves*, xxv, 11, 18, 26, 1945. [Abs. in *Chem. Abstr.*, xl, 3, p. 666, 1946.]

A release of soluble copper is suggested as the principal cause of damage to citrus in some parts of California following treatment with Bordeaux mixture [cf. *R.A.M.*, xxv, p. 65], and experiments are in progress to find substitutes for copper sprays. The following have given encouraging results in brown rot [*Phytophthora citrophthora* and *P. parasitica*] control: dithane [disodium ethylene bisdithiocarbamate: ibid., xxv, p. 215], spergon, and zerlate-milban.

Fawcett (G. L.). **Notas sôbre la podredumbre de las raicillas o 'tristeza' de los Naranjos.** [Notes on the rootlet rot or 'tristeza' of Oranges.]—*Rev. industr. agríc. Tucumán*, xxxv, 1–3, pp. 33–35, 1945.

The form of orange root rot known as 'tristeza' has not yet been detected in Tucumán, but its presence in other parts of Argentina (Corrientes, Entre Ríos, and Misiones) renders most probable its subsequent extension into the first-named Province. The relevant literature is briefly surveyed and Webber's theory of the virus origin of the disease [*R.A.M.*, xxv, p. 111] accepted as the most plausible explanation of its etiology.

Eaton (F. M.) & Rigler (N. E.). **Influence of carbohydrate levels and root-surface microfloras on Phymatotrichum root rot in Cotton and Maize plants.**—*J. agric. Res.*, lxxii, 4, pp. 137–161, 5 figs., 1946.

Investigations are described on the possible competitive influence of microbial elements of the rhizosphere of *Gossypium hirsutum* on *Phymatotrichum omnivorum*. In pot and field experiments with plants of fruiting age low carbohydrate concentration of the root bark [*R.A.M.*, xix, p. 592 and cf. below, p. 318] has been found directly associated with the susceptibility of cotton to *P. omnivorum*. Plants with a low carbohydrate concentration, brought about by artificial interference with photosynthesis, died within two weeks after infection, with intermediate concentration death was delayed for some time, and a high concentration kept them alive. If a high concentration of carbohydrates was kept up for some months, *P. omnivorum* was eliminated from the roots and healthy growth was promoted.

Ultimate recovery of the plant is thought to be due to the increased carbohydrate ratio and the loss of water supply accompanying the death of the lower roots.

At the same time, prolonged experiments have shown that *P. omnivorum* has developed well in culture on high-carbohydrate substrata, and if the organism were present alone when tissues are invaded its growth should be encouraged rather than arrested by a more nutrient substratum. However, the saprophytic organisms encountered under field conditions are considered to confront *P. omnivorum* with competitive conditions of growth on and within the plant tissue. The differences in the carbohydrate concentration cause alteration in the microbial population. It is, therefore, thought likely that an antibiotic effect, amounting with high concentrations to inhibition of *P. omnivorum* and notably changing the microbial equilibria on the surfaces of the *Gossypium* roots, may be operative. The high resistance of seedling cotton, on the other hand, cannot be attributed to the effect of carbohydrate concentration, but rather to a different microbial balance in the rhizosphere.

It would seem that the most productive strains should be the most susceptible and that any field practices which increase yield (and therefore lower carbohydrate concentration in the roots) should also encourage root rot. It appears, however, that the net result in the field is usually a gain even when more plants die.

A similar reaction was observed between root-surface saprophytes and the pathogenic virulence of *P. omnivorum*, maize being quickly destroyed by the fungus on sterile sand-bentonite substrata, and maize roots on natural field substrata resisting attack although closely engaged by hyphae of *P. omnivorum* for considerable distances.

Plant diseases. Diseases of Gladiolus.—*Agric. Gaz. N.S.W.*, lvii, 2, pp. 93–97, 9 figs., 1946.

Brief, popular notes are given on the symptoms and control of the following diseases affecting the corms and foliage of *Gladiolus* in New South Wales: scab (*Bacterium marginatum*) [*R.A.M.*, xix, p. 22], hard rot (*Septoria gladioli*) [ibid., xxi, p. 130], *Botrytis* core rot (*B.* sp.) [ibid., xxiv, p. 373], which is not important in the metropolitan area, but may give trouble in coastal and highland regions, *Fusarium* rot, producing lesions on the corms [ibid., xxiii, p. 300], dry rot (*Sclerotinia gladioli*) [ibid., xxiv, p. 103] (not common or widely distributed locally), mosaic [ibid., vii, p. 517; xxiii, p. 488], and possibly yellows (*F. oxysporum* var. *gladioli*) [ibid., xxiv, p. 418], the presence of which in New South Wales has not yet been definitely established.

LIMASSET (P.). **Les maladies à virus du Dahlia.** [*Dahlia* virus diseases.]—*Rev. hort., Paris*, N.S., xxx, 1, pp. 11–14, 1 diag., 1946.

A scheme of sanitary selection by protracted isolation and testing of stock is propounded for the control of the *Dahlia* viruses, mosaic and [tomato] spotted wilt [*R.A.M.*, xxiv, p. 510], which are sufficiently serious in France to demand drastic measures for their elimination.

CASTELLANI (E.). **Su due malattie del Cyperus rotundus L.** [On two diseases of *Cyperus rotundus* L.]—Reprinted from *Agricoltura colon.*, xxxvi, 6, 7 pp., 3 figs., 1942. [Received February, 1946.]

After stating that the noxious weed *Cyperus rotundus* constitutes a danger to the cotton crops in the Tessenei area of Eritrea, the author describes two diseases of this host found locally. The more prevalent was a rust due to *Puccinia canaliculata* [see next abstract]. The second disease, associated with the first, was a smut identified as *Cintractia peribebuyensis*. Both diseases, especially the latter, appear

to offer some possibility of biological control of the weed, though their importance must not be over-estimated in this respect, since the spread of the host seems to be chiefly due to carriage of the small tubers by flood water.

CASTELLANI (E.). **Sulla presenza di teleutoconidi pluricellulari in 'Puccinia canaliculata' (Schw.) Lagerh.** [On the presence of pluricellular teleutospores in *Puccinia canaliculata* (Schw.) Lagerh.]—*Nuovo G. bot. ital.*, N.S., xlviii, pp. 658–661, 1 fig., 1941. [Received February, 1946.]

The author records the occurrence in October and November, 1937, of tricellular teleutospores of *Puccinia canaliculata* [see preceding abstract] on *Cyperus rotundus* in different parts of Eritrea, over 5 per cent. of the spores being so formed. A few mesospores were also present.

COOLEY (J. S.). **Root diseases of deciduous fruit trees.**—*Bot. Rev.*, xii, 2, pp. 83–100, 1946.

The literature on the fungal, bacterial, and non-parasitic root diseases of deciduous fruit trees is reviewed with special emphasis on their pathological (rather than mycological) and remedial aspects and according particularly comprehensive treatment to those occurring in the eastern States of the American Union. Most of the more recent papers included in the bibliography of 59 titles have already been noticed from the original sources.

Symposium on virus diseases of tree fruits.—*Proc. Canad. phytopath. Soc.*, xii, pp. 21–23, 1944.

G. H. BERKELEY and R. S. WILLISON state that whereas only two virus diseases of stone fruits, peach yellows and little peach, were known to occur in Ontario in 1935, at least 15 are found there now on peach, plum, and cherry. The only serious ones, apparently, are X disease of peach [*R.A.M.*, xxii, p. 162], yellows [ibid., xxiii, p. 234] and necrotic ring spot [cf. ibid., xxii, p. 421] of sour cherry, and plum dwarf [ibid., xxiii, p. 492]. J. F. HOCKEY points out that two virus diseases of apple about which more information is desirable are mosaic [ibid., xxiii, p. 134] and false sting [ibid., xxii, p. 438]. T. B. LOTT discusses the present situation as regards virus diseases of tree fruits in the interior of British Columbia. Cherry-growers have suffered greater losses from crinkle [ibid., xx, p. 6; xxiii, p. 392] than from any other virus disease of this host.

FISCHER (H.). **Eine seltene Fäulnis bei Birnen.** [A rare Pear rot.]—*Schweiz. Z. Obst- u. Weinb.*, lv, 11, pp. 223–225, 2 figs., 1946.

Stored pears in Switzerland are occasionally attacked by *Cladosporium herbarum*, which usually enters either near the pedicel or calyx or through an insect gallery and induces a deep black discoloration of the flesh with a glassy outer layer 2 mm. in thickness. Apples may be similarly affected, but as the disease does not usually occur until after the beginning of January, and then only very exceptionally, the damage from this source is inconsiderable.

LAPÉDAGNE (H.). **Les Cognassiers disséminateurs de la moniliose.** [Quince trees as disseminators of moniliasis.]—*Rev. hort., Paris*, N.S., xxx, 3, pp. 44–45, 1946.

During the autumn of 1945 the writer visited a large number of orchards in the south-west of France, where he found an alarmingly high incidence of *Monilia* [*Sclerotinia fructigena* and *S. laxa*] on peaches, plums, and other fruits [*R.A.M.*, xix, p. 105]. Quinces were shown to serve as the foci of infection, the fruits remaining on the trees and photographed in December bearing sufficient spores to contaminate

the entire district. The trees are grown locally solely as orchard boundaries, no use whatever being made of the fruits, but a proposal for their treatment or eradication at a recent meeting of the Haute-Garonne Horticultural Society encountered strong opposition. It is now suggested that the trees should be compulsorily trimmed to hedge height in order to prevent flowering and the consequent production and spread of inoculum.

Chowdhury (S.). **Wilt of Pineapple in Assam.**—*Curr. Sci.*, xv, 3, p. 82, 1946.

A wilt of pineapple similar to that reported from Queensland as due to *Phytophthora cinnamomi* [*R.A.M.*, xiv, p. 457] has been responsible for considerable damage in Assam of recent years, especially during periods of excessive rainfall. Infection is most prevalent on one- to two-year-old plants and invariably results in cessation of growth, both of the suckers and of the parent plant. The leaves assume a drab-olivaceous tinge, becoming flaccid and dropping, this foliar collapse being the most striking symptom of the early stage of the disease. Subsequent progress of the wilt is slow, and complete shrivelling of the leaves, from the tips downwards, may occupy a period of months. The development of immature fruits is arrested and they colour prematurely, their texture being spongy and the flavour subacid, so that they are commercially valueless. The withered fruit stalks maintain their rigidity, and the fruits can only be dislodged from the pedicels by means of a twisting movement. Extensive root decay may be well advanced before any external symptoms are apparent. The causal organism was identified as a strain of *P. parasitica* and its pathogenicity established by inoculation experiments.

Adsuar (J.). **Transmission of Papaya bunchy top by a leaf hopper of the genus Empoasca.**—*Science*, N.S., ciii, 2671, p. 316, 1946.

The author has recently obtained evidence of the successful transmission of papaw bunchy top by a leafhopper apparently identical with that used by Jensen [*R.A.M.*, xix, p. 201], and later described by Oman as *Empoasca papayae*. Seventy-one out of 90 healthy trees exposed to leafhoppers from diseased plants showed symptoms of bunchy top in about six weeks. The unexposed controls remained healthy.

Ciferri (R.). **General remarks on the technique of testing fungicides 'in vitro'.**—*Int. Bull. Pl. Prot.*, xviii, 5–6, pp. 33 M–37 M, 1944.

Ciferri (R.) & Baldacci (E.). **Causes of error in the 'in vitro' control method of fungicides and description of the Palagi–Terzano 'nebulization bench'.**—Ibid., xviii, 9–10, pp. 65 M–72 M, 3 figs., 1944.

Ciferri (R.) & Baldacci (E.). **The fungicidal power of lime and inert powders.**—Ibid., xviii, 11–12, pp. 81 M–91 M, 1944.

Ciferri (R.). **Checking of accuracy in testing fungicides 'in vitro', and examples particularly as applied to Alternaria, tenuis type.**—Ibid., xix, 3–4, pp. 17 M–21 M, 1945.

Ciferri (R.) & Baldacci (E.). **Comparative experiments on the toxicity of different metals on Alternaria, tenuis type, and Plasmopara viticola.**—Ibid., xix, 5–6, pp. 33 M–37 M, 1945.

These are English versions of Italian papers, already noticed from another source [*R.A.M.*, xxv, pp. 221–224], dealing with the testing of the fungicidal efficacy of spray mixtures.

Insecticides, insect repellents, rodenticides and fungicides of I.G. Farbenindustrie A.G., Elberfeld and Leverkusen, Germany, 19–30 May, 1945.—Item No. 24, File No. xxvi–73. Combined Intelligence Objectives Sub-Committee, 48 pp., London, H.M. Stationery Office, 1945. [Mimeographed.]

On p. 15 of this report Dr. S. A. Hall, United States Civilian Office of the Chief Surgeon, states that the sodium salt of 3-chloro-4-hydroxyphenyl-diazosulphonic acid, prepared by Dr. Urbschat at Leverkusen and tested by Dr. Bonrath, gave perfect control of loose smut of oats [*Ustilago avenae*] and *Fusarium nivale* [*Calonectria graminicola*] on rye. The seed-grain is immersed for 30 minutes in a 0·1 per cent. aqueous solution of the compound.

HASKELL (R. J.). **Extension work in plant pathology in the United States.**—*Proc. Canad. phytopath. Soc.*, xii, pp. 13–14, 1944.

In this summary of a talk given before the symposium on extension work in plant pathology of the Canadian Phytopathological Society on 26 June, 1944, the author briefly outlines the organization of extension work in the United States, which began with the agricultural societies and farmers' institutes and was later taken up by certain agricultural colleges. At present, each State has its own extension service, with the necessary directors, leaders, and specialists, whose headquarters are at the State College. Each county has its agricultural agents. The Federal Office in Washington is modelled on those of the different States. Extension work in plant-disease control is now conducted in 22 States, which employ 36 full- or part-time specialists.

TROTTER (A.). **La fitopatologia nel quadro del popolamento biogeografico della Libia.** [Phytopathology in relation to the biogeographical colonization of Libya.]—*Nuovo G. bot. ital.*, N.S., xlix, 3–4, p. 491, 1942. [Received April, 1946.]

Libya can be considered, in relation to the pathology of cultivated plants, as a series of cultivated islands separated by vast steppes or deserts. The entry of new parasites is impeded by the isolation of the territory by sea and desert, but may be effected by the casual importation of plants. *Exoascus* [*Taphrina*] *deformans*, *Ustilago avenae*, and other fungi have been introduced into Libya in this way.

FLOREY (Sir H. W.). **Some antibiotics, with special reference to penicillin.**—*Mem. Manchr lit. phil. Soc., 1943–45*, lxxxvi, pp. 191–204, 1945.

This is a general survey of outstanding developments in the production and application of antibiotics, with special reference to penicillin.

FRIEDEN (E. H.). **The nature and action of the antibiotics.**—*Tex. Rep. Biol. Med.*, iii, 4, pp. 569–646, 1 pl., 1 graph, 1945.

The author describes this paper as 'an attempt to correlate the most important available data relating to the nature, biological activity, and mode of action of the antibiotics'. Without claiming to be exhaustive, the discussion is believed to include essentially all the specific chemical entities that have been shown to exhibit antibiotic activity. An 11-page bibliography is appended.

MOHAN (R. R.), RAO (T. N. R.), & SREENIVASAYA (M.). **Supplemental value of bran extract in penicillin production.**—*Curr. Sci.*, xv, 4, pp. 108–109, 1946.

S. S. Rao has shown (*Nature, Lond.*, cliv, p. 83, 1944) that the addition of moist wheat bran to the medium increases penicillin production by *Penicillium notatum* and curtails the incubation period. In connexion with a comprehensive programme for the investigation of the microbiologically active principles of wheat bran

[cf. *R.A.M.*, xxiv, p. 240], the writers studied the effect of acid alcohol extracts of the material on the output of penicillin by the mould (*J. sci. industr. Res., India*, iv, p. 377, 1945). In their experiments the use of a bran extract supplement at graded dosages ranging from 0·2 to 0·8 mg., calculated on the basis of total nitrogen, resulted in a 60 per cent. increase of penicillin, the climax being reached on the fifth to sixth day.

MUKHERJEE (S. L.) & SARKHEL (B. C.). **Synthetic liquid penicillin medium with glycerine as the sole source of carbon atom.**—*Nature, Lond.*, clvii, 3988, p. 440, 1946.

The authors record the use of glycerine instead of the more expensive glucose in the following synthetic liquid medium for penicillin production: sodium nitrate 3 gm., potassium chloride 0·5 gm., hydrated magnesium sulphate 0·5 gm., hydrated ferrous sulphate 0·01 gm., potassium dihydrogen phosphate 1 gm., 'bacto-peptone' 10 gm., glycerine 20 or 40 c.c. according as 2 or 4 per cent. V./V. was desired, and distilled water to make 1 l. Very satisfactory results followed when the distilled water was replaced by 1,000 c.c. extract from 100 gm. wheat bran. For each sowing bottle 200 c.c. of this medium were employed. *Pen[icillium] notatum*, G.C. 419, was used and antibacterial activity was recorded in duplicate in standard nutrient broth medium with Oxford A. *Staph[ylococcus] aureus* strain in the usual manner. The 4 per cent. glycerine medium gave an anti-bacterial activity of 350 units after 8 days (pH 6).

BACKUS (M. P.), STAUFFER (J. F.), & JOHNSON (M. J.). **Penicillin yields from new mold strains.**—*J. Amer. chem. Soc.*, lxviii, 1, pp. 152–153, 1946.

Spores from a monoconidial isolate of *Penicillium chrysogenum* X–1612 [*R.A.M.*, xxv, p. 130] subjected to ultra-violet irradiation gave rise to a new strain, Wis. Q 176, which has consistently surpassed its parent in penicillin production, usually by a considerable margin.

WIKÉN (T.). **Studies on the effect of a glass factor upon the formation of antibiotic substance by a member of the Penicillium chrysogenum Thom series.**—Reprinted from *Ark. Bot.*, xxxiii A, 3, 44 pp., 2 figs., 12 graphs, 1946.

When a representative of the *Penicillium chrysogenum* series was grown on synthetic media in vessels made of M (a Swedish resistant product), and Jena, or quartz glass, the first-named caused irregularities in the initiation of the formation of the antibiotic proper to the mould and depressed and curtailed its inhibitory activity in respect of *Staphylococcus aureus*. On the other hand, M glass markedly promoted the growth of the fungus, both by expediting mycelial development and by increasing the yield of dry matter.

HANSON (HAZEL J.), MYERS (W. G.), STAHLY (G. L.), & BIRKELAND (J. M.). **Variation in Penicillium notatum induced by the bombardment of spores with neutrons.**—*J. Bact.*, li, 2, pp. 9–18, 1 fig., 1 graph, 1946.

Marked variation appeared in cultures from spore suspensions of *Penicillium notatum* exposed to bombardment with slow neutrons from a 42-in. cyclotrone for periods of one hour to 134 days, the number of mutants increasing *pari passu* with the prolongation of the time of exposure (*Science*, N.S., ci, pp. 357–358, 1945).

The mutants have almost invariably bred true throughout a number of successive transfers. A screening test, surface cultivation, and preliminary trials in submerged cultivation showed the variant strains to differ greatly in their capacity for penicillin production, some having entirely lost this property, whereas the yields of others considerably exceeded those obtained from the parent culture.

WAKSMAN (S. A.), BUGIE (ELIZABETH), & SCHATZ (A.). **Isolation of antibiotic substances from soil micro-organisms, with special reference to streptothricin and streptomycin.**—*Proc. Mayo Clin.*, xix, pp. 537–548, 1944.

The production of streptothricin and streptomycin [see next abstracts] by certain Actinomycetes is considerably influenced by the composition of the medium and growth conditions. The presence of a growth-promoting substance, such as is found in meat extract, is essential for the production of streptomycin, but not for that of streptothricin. Tryptone or peptone and glucose favour the formation of both.

Both streptomycin and streptothricin are stable against destruction by various organisms; both are sensitive to increasing acidity and the presence of glucose; both resist high temperatures. Both act on various Gram-positive and Gram-negative bacteria, but streptomycin is more active against some bacteria of each group, e.g. *Bacillus mycoides* and *Mycobacterium tuberculosis* in the former, and *Proteus vulgaris* and *Pseudomonas aeruginosa* in the latter, than is streptothricin. Both show limited toxicity to animals and marked activity *in vitro* against various Gram-positive and Gram-negative bacteria.

WAKSMAN (S. A.), REILLY (H. CHRISTINE), & SCHATZ (A.). **Strain specificity and production of antibiotic substances. V. Strain resistance of bacteria to antibiotic substances, especially to streptomycin.**—*Proc. nat. Acad. Sci., Wash.*, xxxi, 6, pp. 157–164, 1945.

In the fifth paper of this series [cf. *R.A.M.*, xxiv, pp. 426, 463] evidence is presented showing that different strains of the same bacterial species may vary widely in sensitivity to streptomycin [see preceding abstract].

A strain of *Proteus vulgaris* resistant to streptomycin showed some resistance to streptothricin but none to clavacin. A strain of *Staphylococcus aureus* slightly resistant to streptomycin showed no resistance to streptothricin. Strains of *S. aureus* showed highly resistant to streptomycin, no increased resistance to clavacin and only faintly increased resistance to streptothricin.

BONDI (A.), DIETZ (CATHERINE C.), & SPAULDING (E. H.). **Interference with the antibacterial action of streptomycin by reducing agents.**—*Science*, N.S., ciii, 2674, pp. 399–401, 1946.

The anti-bacterial activity of streptomycin in infusion agar cultures of *Escherichia* [*Bacterium*] *coli* and other bacteria was shown to be diminished by anaerobic incubation for 24 hours at 37° C. The bacteriostatic properties of the antibiotic in respect of *Bact. coli* were also reduced by the presence in the medium of cysteine, sodium thioglycocollate (both at 0·1 per cent.), stannous chloride, sodium bisulphite, sodium hydrosulphite (all at 0·05 per cent.), sodium formate, and sodium thiosulphate (both at 0·5 per cent.), the first-named being the most active antagonist.

ATKINSON (NANCY). **Toadstools and Mushrooms as a source of antibacterial substances active against Mycobacterium phlei and Bact. typhosum.**—*Nature, Lond.*, clvii, 3988, p. 441, 1946.

In a survey of over 200 kinds of mushrooms and toadstools collected in South Australia, anti-bacterial activity of aqueous extracts was observed in several members of *Cortinarius* and one of *Psalliota*. All the active extracts inhibited the growth of *Staph*[*ylococcus*] *aureus*, but those of two only showed wider activity, viz., those of *C. rotundisporus* and *P. xanthoderma* inhibited *S. aureus*, *Bact*[*erium*] *typhosum*, and *Myco*[*bacterium*] *phlei*.

The extracts from *C. rotundisporus* were more active against *S. aureus* than against *Bact. typhosum*, whereas those from *P. xanthoderma* were about equally

active against both. The activity of all the extracts against *M. phlei* was well marked, but weaker than that shown against *S. aureus*. The extracts of *Psalliota* were more readily inactivated by heat and alkalinity than were those of *Cortinarius*.

HOLLANDE (A. C.). **Lyse massive des bacilles de Koch chez le cobaye après traitement à la clitocybine. Pouvoir inhibiteur de ce produit vis-à-vis du bacille typhique, du colibacille, de Brucella abortus etc.** [Mass lysis of Koch's bacilli in the guinea-pig after treatment with clitocybin. Inhibitory property of this product in respect of the typhus bacillus, the coli bacillus, *Brucella abortus*, &c.]—*C.R. Acad. Sci., Paris*, ccxxi, 13, pp. 361–363, 3 figs., 1946.

This is a preliminary note on the antibiotic properties of clitocybin in respect of Koch's bacillus [*Mycobacterium tuberculosis*] and other pathogenic micro-organisms [see next abstract].

HOLLANDE (A. C.). **L'action de la clitocybine sur le bacille tuberculeux et autres microbes.** [The action of clitocybin on the tubercule bacillus and other microbes.]—*Atomes, 1946*, 3, pp. 1–5, 5 figs., 1946.

Clitocybe candida, an edible fungus occurring in Alpine meadows at an altitude of 800 to 1,000 m. in the Isère Department, France, yields an extract, clitocybin, which was experimentally shown to exert a bacteriostatic effect on *Staphyloccus aureus*, the tubercle bacillus [*Mycobacterium tuberculosis*] (which was particularly sensitive), *Brucella abortus*, the coli bacillus [*Bacterium coli*], and the pyocyanic bacillus [*Bacillus pyocyaneus*]. After extraction by sulphuric ether and purification, clitocybin, redissolved in water, is innocuous to guinea-pigs. Progressive and total lysis of *M. tuberculosis* was observed in infected guinea-pigs treated with the antibiotic.

Report on visit to the Zellstoffefabrik A.G. (Waldhof), Kelheim, near Regensburg.—Final Report No. 5, Item No. 22, British Intelligence Objectives Sub-Committee, 3 pp., London, H.M. Stationery Office, 1945. [Mimeographed.]

W. G. Campbell and H. J. Bunker visited the Waldhof cellulose factory, Kelheim, near Regensburg, on 9th August, 1945, and report as follows on yeast production, which was begun in 1944. The works are engaged primarily in the preparation of wood pulp by the ordinary sulphite process, the waste liquor thus obtained being fermented by *Torula* [*Torulopsis*] *utilis* [*R.A.M.*, xxv, p. 270]. Fermentation is continuous, the flow through the fermentation vessel containing 50 to 55 cu.m. liquid and 200 to 250 cu.m. foam being 10 cu.m. an hour. Under normal conditions the average output of the plant was 7 tons a day, and the material was used both for human consumption and for fodder.

Developments in pure and applied microbiology in Germany (American, British, and French zones) during world war II.—Final Report No. 236, Item No. 22, British Intelligence Objectives Sub-Committee, pp. 21–49, London, H.M. Stationery Office, 1945. [Mimeographed.]

Full particulars are given of the information obtained in 1945 by A. K. Balls (United States Department of Agriculture), D. H. F. Clayson (British Ministry of Food), and G. A. Ledingham (Canadian Department of Reconstruction) relative to the production of *Torula* [*Torulopsis*] *utilis* [see preceding abstract] on wood sugars by the Bergius process at the South German Wood Saccharification Plant at Regensburg, and by the Scholler process at the Holzminden Sugar and Chemical Industry Works, the development of *Oidium* [*Oospora*] *lactis* on waste sulphite

liquor at the Lenzing (Austria) cellulose and paper factory, and the laboratory and pilot plant-scale production of fat from *O. lactis* at the Association of Biological Chemistry, Bad Tölz. At the Prussian Dairy Experiment and Research Station strains of *Fusarium*, *Candida*, *Oidium* [? *Oospora*], *Endomyces*, and *Rhizopus* were being successfully utilized for protein production, and the firm of C. H. Boehringer, Jr., Oberingelhein, near Bingen, were manufacturing gluconic and citric acids through the action of *Aspergillus niger* on acid-hydrolysed potato starch solution and beet molasses, respectively.

PEYRONEL (B.). **Ricerche sulla simbiosi micorrizica nelle Epatiche.** [Researches on mycorrhizal symbiosis in the Hepaticae.]—*Nuovo G. bot. ital.*, N.S., xlix, 3–4, pp. 362–382, 4 figs., 1942. [Received April, 1946.]

After reviewing and discussing earlier studies by different workers on the mycorrhiza of the Hepaticae the author describes his own investigations. These showed that in the thalli of *Fegatella conica*, *Lunularia cruciata*, *Pellia fabbroniana*, and *P. neesiana* there is a double infection due to (1) a Phycomycete with arbuscules and vesicles [? *Rhizophagus*: *R.A.M.*, xviii, p. 470; xxv, p. 178] which penetrates the rhizoids and invades the amyliferous parenchyma of the thallus, and (2) probably a *Rhizoctonia* localized in the rhizoids and the dead parts of the thallus. The first probably belongs to the Endogonaceae or to *Mortierella*. A *Mortierella* with a mycelium closely resembling that of the endophyte was isolated from thalli of *F. conica*.

In the leafy Hepaticae only the *Rhizoctonia* was found. Infection by the Phycomycete was closely connected with environmental factors. Lack of humus and of light reduced infection, while the presence of humus favoured it. Humidity reduced infection, as a rule. The relations between Hepaticae and the Phycomycete are generally those of symbiosis.

A bibliography of 86 titles is appended.

MCCLINTOCK (BARBARA). **Neurospora. I. Preliminary observations of the chromosomes of Neurospora crassa.**—*Amer. J. Bot.*, xxxii, 10, pp. 671–678, 3 figs., 1945.

BEADLE (G. W.) & TATUM (E. L.). **Neurospora. II. Methods of producing and detecting mutations concerned with nutritional requirements.**—Ibid., xxxii, 10, pp. 678–686, 1945.

In the first contribution observations are reported on the chromosomes and nuclei in the ascus from fertilization to spore formation of normal strains and three irradiation-induced mutants of *Neurospora crassa* [*R.A.M.*, xxiii, p. 268]. In the second the nutritional requirements and genetic differences induced in mutant strains of *N. crassa* and *N. sitophila* by X-rays, ultra-violet radiation, or neutron bombardment [cf. above, p. 307] were studied.

WHITE (N. H.). **Biochemical contributions to the knowledge of fungal diseases of plants.**—*Aust. chem. Inst. J.*, xii, 9, pp. 291–295, 1945.

The literature on three examples of fungal diseases of plants is reviewed to illustrate the application of biochemistry to these problems, namely, onion smudge (*Colletotrichum circinans*) [*R.A.M.*, xii, p. 672], tomato vascular wilt (*Fusarium* [*bulbigenum* var. *lycopersici*]) [ibid., xxiii, p. 244], and the obligate parasites, rusts and powdery mildews. All are characterized by the production of phenolic compounds resulting from the activity of the oxidizing enzyme systems in plant tissues. It is suggested that this process is the result of decompensated respiration, a phenomenon accompanying various types of parasitism in plants.

BALDACCI (E.). **La resistenza delle piante alle malattie.** [The resistance of plants to diseases.]—261 pp., 14 figs., Genova, Società Anonima Editrice Dante Alighieri (Albrighi Segati, e C.), 1942. 35 L. net. [Received March, 1946.]

In the first part of this book, the author discusses in detail various immunological hypotheses that have been put forward by different workers to account for the resistance of plants to disease. He then deals with the known factors of resistance, particularly defence against penetration and defensive reactions during infection by certain types of disease [cf. *R.A.M.*, xviii, p. 757], including virus diseases. In the third section, attention is paid to variations in resistance induced by mineral nutrition, the application of organic and inorganic compounds, and in relation to photosynthesis, and other factors. The work concludes with a brief critical review of the available experimental data.

STEVENSON (F. J.). **Potato breeding, genetics, and cytology: review of recent literature.**—*Amer. Potato J.*, xxii, 2, pp. 36–52, 1945.

Among the 37 papers listed and briefly summarized in this review of recent literature on various aspects of potato-breeding are several concerned with resistance to virus diseases, late blight (*Phytophthora infestans*), scab (*Actinomyces scabies*), etc., most of which have already been noticed from the original sources.

HANSEN (H. P.). **Studier over Kartoffelviroser i Danmark III. Om betingelserne for virusspredning samt kortlægning af deres geografiske fordeling.** [Studies on Potato viruses in Denmark III. On the conditions for virus dissemination, with charting of their geographical distribution.]—Thesis, Veterinary and Agricultural College, Copenhagen, 134 pp., 1 diag., 10 graphs, 7 maps, 1941. [English summary. Received April, 1946.]

Continuing his studies on potato viruses in Denmark [*R.A.M.*, xxii, p. 36; cf. also ibid., xxv, p. 178], the author carried out a number of field experiments, covering a period of three years, on the factors affecting the behaviour of the aphid, *Myzus persicae*, responsible for the dispersal of virus Y. The trials were conducted in 40 localities in 1938 and eight in 1939, while numerous counts of aphids in potato fields were made in the same two years and in 1940, all parts of the country being uniformly represented.

The results were examined statistically, and the influence of topographical and meteorological factors, such as wind, relative humidity, and temperature, were studied with the aid of a slide-rule specially designed by the author which facilitated calculations involving four independent variables of proportionals for infection conditions. To test the spread of infection isolated plots were used having seven rows with 25 plants per row, the rows, from east to west, arranged thus: virus Y, healthy two rows, virus X, healthy two rows, virus Y.

The dissemination of infection within the individual plots was shown to be practically identical on the eastern and western sides. The incidence of the disease averaged about 1½ times higher in the rows adjoining those infected by virus Y than in the ones separated by a row from the source of contamination. The effect of shelter from the wind varied with the other general conditions for infection. Thus, in localities with a high infection percentage, the number of diseased plants and extent of aphid infestation were not much greater in sheltered plots than in the open field. Where the infection percentage was moderate there was an average of 67 per cent. more virus Y and a correspondingly larger number of aphids in sheltered spots than in the open. In places with a very low infection percentage the number of aphids was still much larger in sheltered than in exposed situations, but nevertheless the average incidence of virus Y was relatively high in the latter, presumably owing to transmission through the agency of wind mutilation. The

latter mode of dissemination is considered unlikely to assume any practical importance in seed-potato production.

Virus Y was strikingly more prevalent in the immediate vicinity of towns and of the coast, at any rate in low-lying areas, than in comparable regions at a distance from these centres. For example, in 1938 the maximum incidence of infection in the whole country (78·6 per cent.) was recorded at Egholm in the Great Belt, while other relatively high percentages were reported from Højer Marsh (36·5), Thorstedlung on Roskilde Fjord (44·7), and near the town of Borris (west Jutland), situated in the midst of water-meadows (34·6). On 1st August, 1939, the number of aphids per 100 leaves near the town of Varde (west Jutland) was 248 compared with 126 3 km. to the north; at Skanderborg (east Jutland) on 27th July 191 per 100 leaves and 3 km. to the east only 14; while in bogland in South Zealand and west Jutland maxima of 680 and 580 aphids, respectively, per 100 leaves were reached on 21st July.

An investigation in 1938 on the connexion between infection percentages and meteorological factors resulted in the establishment of a high degree of positive correlation between the mean July temperature and the incidence of virus Y but the line of regression was not straight. However, straight-lined regression did occur between the logarithms of the infection percentages and the mean July temperature. Calculations were further made on the correlation between the logarithms of the infection percentages and most of the available meteorological data on the basis of experimental results in localities remote from towns or marshy areas. The coefficient was highest for the mean July temperature, and since the aphid population develops largely during this month the connexion may be regarded as biologically significant. The experimental localities were then relegated to three groups, viz., (1) less than 1 km. from towns or marshes and the like, which appear to favour the hibernation of *M. persicae*; (2) 1 to 3 km. from the foregoing and less than 1 km. from villages and moorland areas; and (3) over 3 km. from towns and marshes, &c., and more than 1 km. from villages and moorlands. In group (1) the average deviation in the logarithms of the infection percentages between the observed data and those expected on the basis of the mean July temperature, number of rainy days in June, and relative humidity in June was +0·4587, the corresponding figures for (2) and (3) being +0·0917, and −0·0893, respectively. These figures afford unmistakable evidence that virus Y infection diminishes rapidly with increasing distance from towns and low-lying areas under comparable meteorological conditions.

From aphid counts in 1939 it was learnt that the number of insects increases on a logarithmic scale during the early part of the season [cf. ibid., xx, p. 420], a clear positive correlation being found between temperature and the number of generations. The average daily logarithmic increase was 0·0912 at 16·8° C. Presuming an even distribution of aphids over the fields, the incidence of virus Y infection should, according to logical expectation, be directly proportional, in normal years, to the total number of aphid-days within the season.

The meteorological conditions influencing the flight of alate aphids were also studied. It was difficult to differentiate the effect of the June temperature on flight from that of the same factor in July on multiplication, but this is a matter of no great moment, since the latter is the more important of the two conditions, and in any case the resultant trends are in the same direction. There was no true correlation between wind velocity in June and the incidence of virus Y except when sheltered plots were compared with those in the open field, probably because the meteorological data relating to this factor are not applicable to the conditions prevailing at soil-level, whence the alate aphids set off on their flight. The incidence of infection in the test plots was negatively correlated with the relative atmospheric humidity in June and the number of days of rainfall, but not with the amount of

precipitation measured in mm. The explanation of this apparent discrepancy is presumably that the relative humidity of the air circulating round the plants depends on both the atmospheric humidity, measured at a height of 2 m. above ground-level, and the number of rainy days. The mathematical expression of the relationships of these factors is discussed.

It is concluded from the foregoing data that the correlation between the number of days of rainfall and logarithms of the infection percentages is due to true biological causes.

In the course of these investigations several cases of partial infection of Bintje plants with virus Y were observed. It frequently happens that the progeny of a plant attacked during the current season consists of a mixture of sound and diseased individuals, while the virus may also be localized in single tubers. In plants arising from the latter, one or more shoots may show symptoms of rugose mosaic, while the rest look quite healthy during the first few weeks of the season. Obviously, therefore, the virus moves very slowly in maturing plants, while in dormant tubers it is probably quiescent. Serological tests, moreover, indicate that the virus concentration in thoroughly infected dormant tubers is very low.

STEVENSON (F. J.), SCHULTZ (E. S.), AKELEY (R. V.), & CASH (LILLIAN C.). **Breeding for resistance to late blight in the Potato.**—*Amer. Potato J.*, xxii, 7, pp. 203–223, 1945.

Several progress reports on the programme of potato-breeding for resistance to late blight (*Phytophthora infestans*) initiated 12 years ago by the United States Department of Agriculture co-operating with the Maine Agricultural Experiment Station have already been published [*R.A.M.*, xvii, p. 267]. The present paper tabulates the results up to date and includes a discussion of some of the more recent family lines and potential commercial selections.

Varieties showing reactions to the pathogen ranging from complete susceptibility to immunity have been used as parents in the project. A few seedlings with an intermediate type of resistance arose from crosses between two susceptible varieties, such as Chippewa and Katahdin, but a much larger proportion was produced when intermediates, e.g., President and its relatives, served as progenitors of selfed lines and crosses. The intermediates of the latter series were all late and did not excel Sebago in other characters. Selections from the original introductions of the German *W* races proved highly resistant to blight and early maturing, but their yields were low and their market quality inferior. However, the offspring of crosses between some of these selections and American varieties and seedlings, for instance, Earlaine, Katahdin, and 336–18, retained the blight resistance of their foreign parents with the addition of commercially desirable features. A number of these crosses were in turn selfed, sib-mated, and out-crossed to different commercial varieties and promising seedlings with highly encouraging results, and it is hoped shortly to name and distribute one or more of the progenies to growers. No significant correlation was established between time of maturity and reaction to *P. infestans* in several selections segregating for both characters.

EDDINS (A. H.). **Transmission and spread of late blight in seed Potatoes.**—*Amer. Potato J.*, xxii, 11, pp. 333–339, 2 figs., 1945.

The results of experiments carried out at Hastings, Florida, showed that late blight (*Phytophthora infestans*) spreads from diseased to healthy Maine-grown tubers in seed bags under certain conditions, notably when the potatoes are stored out-of-doors, remaining wet for protracted periods during rainy weather, or kept in continuous shade where drying after rain takes place slowly. The average percentage of loss from the disease over the period from 1936 to 1945 was 4·8.

The development of the pathogen was favoured by 25 rainy days in December, 1936, and January, 1937, when 15 per cent. of the seed exposed to the weather contracted infection; after it was planted, the fungus made rapid growth in the seed pieces and formed spores on the sprouts and young stems. Much of the diseased seed dies or produces poor plants. Numerous primary infections were observed in the field and in the greenhouse, but the data were insufficient to define the conditions under which the disease originates from infected seed planted in the field.

Infected seed is concluded to be the primary source of late blight in Florida. The transmission and spread of the fungus should be largely preventable by digging the tubers after the tops have matured and died or been destroyed by frost or herbicides [*R.A.M.*, xxv, p. 276] and discarding all contaminated material before dispatch.

LARGE (E. C.). **Field trials of copper fungicides for the control of Potato blight. I. Foliage protection and yield.**—*Ann. appl. Biol.*, xxxii, 4, pp. 319–329, 7 graphs, 1 diag., 1945.

The author presents the results of eight replicated trials at several centres in Cornwall during 1941 to 1944 of Bordeaux mixture and some recently introduced copper fungicides for the control of potato blight (*Phytophthora infestans*). In the course of the experiments the author sought to determine (1) the extent of disease incidence on the foliage at successive dates with a view to ascertaining the conditions of the tests and appraising the degree of protection afforded by the fungicides to the foliage; and (2) the degree of spray retention. Mean assessments of disease intensity for whole plots were represented by the categories 0·0, 0·1, 1, 25, 50, 75, and 100 per cent. foliage destroyed, in conformity with the British Mycological Society's recommendations in 1942 [*R.A.M.*, xxii, p. 365].

The progress of infection on the sprayed foliage followed much the same course as on the untreated only, however, after a time lag conditioned by the timing of spraying in relation to that of *Phytophthora* attack. The results showed that in 1941, when in August heavy rains occurred between the second spraying and the appearance of the first blight symptoms, both sprayings were given a month too early; in 1942 sprayings coincided remarkably with the attack of the pathogen and maximum prolongation of growth was secured; the second spraying in 1943 was given too late, the disease being already present and over 1 per cent. of the foliage infected; while in 1944, three cold, dry days are considered to have arrested the progress of the pathogen and thus rendered the second spraying premature.

In order to measure the prolongation of growth resulting from spraying, the date of 'half-decay' was plotted on foliage decay curves and the time lag then determined between the dates of decay in sprayed and unsprayed foliage, which is thought to offer the most reliable single numerical criterion of the direct effect of spraying.

In plotting the foliage-decay curves the probit transformation method described by C. I. Bliss (*Ann. appl. Biol.*, xxii, p. 307, 1935) was adopted, and it was found in the present experiments that there was often an approximately linear relationship between probit-leaf destruction and time, although at first there was no ground for assuming that the normal course of foliar destruction would tend to follow the probability-integral law on which Bliss's method is based. Throughout the author's trials this relationship held true in respect of unsprayed foliage, within limits of accuracy of the original determinations of foliage damage; and where linear divergences occurred on the curves for sprayed foliage, this was associated with varied meteorological conditions during the period of *Phytophthora* infection. The use of the probit transformations for potato-blight progress curves is justified

by comparing the curves obtained by this method and those obtained by using the growth law based on suggestions by Jensen and Rostrup (1892).

The mean prolongation of growth obtained from all the trials during the three-year period was 16½ days.

Potato yields are conditioned by so many factors other than those of foliar protection, that their data have little practical value in comparative tests of spraying material [*R.A.M.*, xvii, p. 260], the results of past work on the subject finding confirmation in the present studies. Although the data here collected present disparities between the yields from sprayed and unsprayed crops which are highly important, the differences in yield between respective treatments were often so insignificant as to have little or no practical value.

Obvious differences, however, in the direct prophylactic effects of the various sprays on potato foliage were fairly constantly associated with the spray retention factor. The enduring protective value of Bordeaux mixture (4–5–40) was once more reaffirmed, although cuprous oxide plus bentonite sticker proved almost equivalent at the same copper dosage. Bordeaux mixtures at half their copper dosage were just as effective as cuprous oxide and copper oxychloride, compounded with water-soluble dispersing agents and without stickers. There was little to choose between metallic copper, compounded with bentonite in relatively coarsely divided form, and finely sifted cuprous oxide without sticker at the same copper dosage. The fungicidal action of cuprous oxide has been attributed to the copper made available as the cupric ion and not to that deposited as more or less inactive copper metal, but it is concluded that any metallic copper so formed must undergo rapid oxidation on exposure and the whole of the copper thus becomes effective fungicidally.

SMALL (T.). **The effect of disinfecting and bruising seed Potatoes on the incidence of dry rot (Fusarium caeruleum (Lib.) Sacc.).**—*Ann. appl. Biol.*, xxxii, 4, pp. 310–318, 1945.

Continuing his investigations [*R.A.M.*, xxiv, p. 201] into potato tuber dry rot, caused by the wound parasite *Fusarium caeruleum*, the author shows in experiments made with the susceptible variety Ninetyfold, bruised and disinfected [ibid., xxiii, p. 38] with a proprietary organo-mercury preparation, aretan, that tubers bruised at digging time and disinfected at once were little damaged by dry rot in the majority of tests made. Disinfection at a later date retarded the disease somewhat in certain cases, but not in others. Seed-tubers, well bruised one or two weeks after disinfection were with one exception almost entirely healthy. On the other hand, in the course of four out of six tests serious dry rot developed in tubers severely bruised about three months after disinfection. The result of inoculating sound tubers with soil samples showed that the pathogen is widely present in Cheshire potato fields. Seed-tubers, whether disinfected or not at harvest time and not experimentally bruised remained healthy until planted in the following year, provided they were left undisturbed in their boxes. Others, experimentally bruised at harvesting or one or two weeks later, almost all suffered serious injury from *F. caeruleum*. By October the pathogen was no longer active, but when sound, untreated tubers were bruised in October, they at once developed dry rot, although disinfection before bruising controlled the loss adequately in five out of six tests.

It is regarded as highly likely that in lofts, sacks, hampers, and the like, *F. caeruleum* remains viable from one season to another and contaminated tubers may suffer further from disturbance by storage-workers and also derive fresh infection where, for example, the pathogen is present in dust diffused when lofts are swept. Contaminated seed arriving at warehouses and being discharged into boxes can spread the disease. Of 70 sound, treated tubers, cut in half with a sterile knife and

exposed to floor sweepings, 70 halves being placed in a moist chamber and 70 left in store, 60 of the former and 36 of the latter contracted dry rot.

The general conclusion reached confirmed Foister and Wilson's findings [loc. cit.] that dipping of seed potatoes is undoubtedly an important means of protecting them against damage in the course of handling or storage. This is particularly true in the case of imported seed-tubers, although those locally produced sometimes develop dry rot in the circumstances mentioned. The present studies suggested that the best time for dipping is just before the tubers are likely to require handling, or if this is impracticable, immediately after handling. Aretan, or other organo-mercury compounds, and formaldehyde [ibid., xix, p. 614] have proved satisfactory, although their period of efficacy may be limited, as suggested by the appearance of dry rot in disinfected seed-tubers subsequently exposed to further bruising. In view, also, of their poisonous nature, a harmless fungicide is much to be desired. As regards clamped tubers, the writer's experience in 1943–4 indicates that for seed-potatoes undamaged when clamped down adequate protection against subsequent dry rot is offered by dipping immediately the clamp is opened and, if this continues to be confirmed, the question of labour difficulties presented by disinfection at lifting time should be removed. It may be advisable to make such delayed treatments longer and more thorough than in the case of tubers freshly dug and still moist.

BLODGETT (E. C.) & RAY (W. W.). **Leak, caused by Pythium debaryanum Hesse, produces typical 'shell rot' of Potato in Idaho.**—*Amer. Potato J.*, xxii, 8, pp. 250–253, 1 fig., 1945.

Pythium debaryanum was the agent of a widespread tuber rot in the Idaho potato crops of 1943 and 1944, particularly heavy damage having been sustained in the latter year. The outstanding symptom in stored potatoes is the disorganization of the interior of the tuber into a soft, brown decay, leaving in most cases a shell of sound tissue, up to $\frac{1}{4}$ in. in thickness, almost completely surrounding the affected area, hence the popular designation of 'shell rot'. During the month or so immediately following digging, however, the predominant feature of infection was a leak, ultimately involving the whole tuber in a very watery breakdown. High temperatures during and just after harvest appear to be a decisive factor in the development of infection in any particular lot. Samples of diseased tubers from different localities consistently yielded *P. debaryanum* [*R.A.M.*, xxiv, p. 202].

Two facts are noteworthy in this account, namely, the occurrence of leak in storage (it has long been known as a disease of the early crop in Idaho), and its hitherto unrecognized connexion with the 'shell-rot' complex.

BONDARTSEV (A. S.). К пораженію картофеля опенком **Armillaria mellea (Vahl) Quél.** [The honey agaric fungus, *Armillaria mellea* (Vahl) Quél., pathogenic on Potato.]—*Sovetsk. Bot.*, xiii, 5, p. 28, 1 fig., 1945.

The author describes the infection of potato tubers by *Armillaria mellea* [*R.A.M.*, xvi, p. 832] observed in 1942 on allotments in the grounds of the Komarov Botanical Institute in Leningrad, and believed to be the first record of an attack on potato by this pathogen in Russia. It is recommended that potatoes should not be sown in newly-dug park or forest land as a means of avoiding a further appearance of this disease.

Symposium on bacterial ring rot of Potatoes. Present status of bacterial ring rot in Canada.—*Proc. Canad. phytopath. Soc., 1944*, pp. 14–17, 1944.

The only practical means of controlling bacterial ring rot of potatoes (*Corynebacterium sepedonicum*) [*R.A.M.*, xxiii, p. 275; xxiv, pp. 31, 246] consists in eliminating the disease on farms where it already exists and preventing its intro-

duction into districts where it has not yet appeared. All potatoes on an affected farm should be disposed of, and in such a manner that they do not find their way to another farm, to be planted there. All storage places and tools should be disinfected, and clean seed planted the next season. To prevent the introduction of the disease, only fully certified seed should be purchased, and all used bags disinfected. The Dominion Department of Agriculture is controlling ring rot in certified seed [cf. ibid., xxii, p. 9], but it rests with the Provincial Departments to control it in table stock.

The main difficulty in control is detection in trace infections. The simplest way is to follow the digger at harvest and watch for affected potatoes. The next-best time is when the potatoes are being graded after four weeks' storage or more. Detection is even easier in spring, when more tubers have broken down. Culls should be examined carefully.

The next difficulty is to prevent infection on a farm when the disease is present in the vicinity. Infection may occur through an exchange of machinery, careless cutting by inspectors or purchasers of diseased tubers on one farm and healthy ones on another with the same unwashed knife, the exchange of empty used bags, and the indiscriminate planting of odd lots of potatoes. Constant vigilance is essential.

NIELSON (L. W.) & TODD (F. A.). **Preliminary evaluation of some soil disinfectants for controlling southern bacterial wilt of Potatoes.**—*Amer. Potato J.*, xxii, 7, pp. 197–202, 1945.

In preliminary experiments on the variety Irish Cobbler in eastern North Carolina in 1943 and 1944, the application to the soil before ploughing of sulphur-lime, as used by Eddins in Florida [*R.A.M.*, xvi, p. 271], lime-urea (uramon), recommended by Smith and Clayton [ibid., xxii, p. 278], and ammonium thiocyanate (1,000 lb. per acre), effective against *Synchytrium endobioticum* in R. H. Bell's trials in Pennsylvania [ibid., xv, p. 112], gave promising results in the control of southern bacterial wilt (*Pseudomonas* [*Xanthomonas*] *solanacearum*). In the former year the three treatments (in the order named) reduced the incidence of infection from 30·6 to 11·2, 4·8, and 0, and in the latter from 53 to 16, 0·4, and 2·2 per cent., respectively.

WAGER (H. G.). **The effect of P_H on stem-end blackening of Potato.**—*Bio-chem. J.*, xxxix, 5, pp. 482–484, 2 graphs, 1945.

The greyness of cooked potatoes of certain varieties (stem-end blackening) [*R.A.M.*, xxv, pp. 33, 358] was estimated at a range of P_H values and found to increase rapidly towards the upper limits. The absorption of light by a water extract of stem-end blackening pigment at P_H 1 to 9 was also measured. On the basis of these experiments the defect is attributed to the action of a single pigment, the colour of which is reversibly affected by P_H, variations between different stocks in the degree of blackening being due to disparities in the amounts of the pigment they contain.

SAHA (J. C.). **Hot water treatment of Paddy seeds against seed borne infection of Helminthosporium.**—*Sci. & Cult.*, xi, 9, pp. 502–503, 1946.

At the Presidency College, Calcutta, the writer obtained complete elimination of *Helminthosporium* [*oryzae*: *Ophiobolus miyabeanus*] in the Boldar, Marichbati, Latisail, Larkoch, and Jhanjee rice varieties by four hours' immersion in water heated to $54° \pm 0·5°$ C. The treatment also increased the germinability of the seed if sown immediately, and even after storage for a week or longer the loss in germinative capacity did not exceed 5 per cent. The cost of this method of control would

be negligible in comparison with the damage caused annually by the disease, particularly in Bengal, and the necessary conversion of the existing machinery for bulk treatments, say of 40 to 80 lb. lots, should be quite feasible.

Sanford (G. B.). **Soil-borne diseases in relation to the microflora associated with various crops and soil amendments.**—*Soil Sci.*, lxi, 1, pp. 9–21, 1 fig., 1946.

In an attempt to elucidate the factors affecting soil-disease incidence the author selects five common soil-borne diseases, four of which, common scab (*Actinomyces scabies*) and stem canker (*Rhizoctonia* [*Corticium*] *solani*) of potato and the wheat rots (*Helminthosporium sativum* and *Fusarium culmorum*), are also vigorous soil saprophytes, and the fifth, *Ophiobolus graminis*, which is not, and reviews the relevant work on them.

Previous research on the effect of soil moisture content and organic manuring on scab incidence pointed to the possibility that they acted advantageously when they favoured an antagonistic microflora. Two experiments carried out by the author show that the addition of chopped green rye or clover to soil artificially infected with scab reduced the incidence of the pathogen in tubers planted in it by 17 and 30 per cent. using rye and by 8 and 49 per cent. using clover. As other external conditions were kept constant and were favourable to disease incidence it was assumed that the differences were due to the antibiotic microflora encouraged by the treatment. Petri dish soil-on-agar cultures demonstrated the antibiotic action of certain soil-inhabiting bacteria to the scab, stem-canker, and root-rot (*H. sativum*) organisms.

Evidence from various sources, particularly in relation to stem canker, suggests that the detection of antibiotic activity in culture does not necessarily imply that the same may occur in the field. This and the results of the author's own experiments on the incidence of *C. solani* in inoculated soil with different manurial amendments show that microfloral activity is very variable, and that it may be the quality rather than quantity that matters.

In reviewing the conditions favouring the incidence and increase of the three root-rot organisms and their ability to reinfect after a period without the host, the behaviour of *H. sativum* and *F. culmorum* on the one hand is contrasted with that of *O. graminis* on the other. The evidence is discussed for considering whether the different behaviour of the last-named is due to its more highly specialized parasitic nature or to its greater sensitivity to antagonistic microflora either in the decomposing plant remains or in the rhizospheres of the succeeding crops.

The author then goes on to survey the literature on the rhizosphere, from which it is apparent that the rhizosphere population is different from that of the soil outside in quality, quantity, and nutritional requirements, and its nature seems to depend on the type of plant rather than on the type of soil. He suggests that it might be possible to modify the microbial balance without resorting to antibiosis, citing as an example the differential effect of soy-bean and red clover as cover crops on the incidence of strawberry root rot [*R.A.M.*, xx, p. 540]. Here the control by soy-bean is attributed to the effect of the decomposition products on the microflora. Another example is the effect of resistant and susceptible varieties of flax on the growth of various root fungi in their rhizospheres. Susceptible varieties of flax and tobacco have also been shown to support different rhizosphere populations from the corresponding resistant varieties.

The writer sees the whole as a complex problem in which the different nutritions of the host, pathogen, and the microflora are regarded as the basic factors in disease incidence. Root excretions of both host and non-host plants might influence adversely or favourably the host-pathogen status either by acting on the pathogen directly, or indirectly by affecting the micro-organisms which may influence its life. The study of soil amendments in these respects is thus very important.

Chupp (C.). **Soil temperature, moisture, aeration, and pH as factors in disease incidence.**—*Soil Sci.*, lxi, 1, pp. 31–36, 1946.

After reviewing the interrelationships between air temperature and soil temperature, the author cites the reactions of many well-known fungi to these factors. For instance, species of *Cercospora* multiply readily in hot, and those of *Septoria* in temperate climates; the tomato wilt (*Pseudomonas* [*Xanthomonas*] *solanacearum*) appears rarely under the climatic conditions of New York State, although large consignments of seedlings are imported annually from Georgia, where the warm climate renders the disease a serious concern to the grower. *Phytophthora infestans* is highly sensitive to temperature changes, so that the raising of the soil temperature by a few degrees may suffice to ward off a serious attack of potato blight.

Other examples are given of the influence of soil moisture and soil reaction. The fact that parasites have an optimum range of pathogenicity for these conditions is well known. Where this range is narrow the virulence of attack may be controlled by extending these conditions beyond the range of tolerance of the fungus. On the other hand, some fungi are more widely tolerant and therefore more difficult to control in this way. Even so these physicochemical factors are so closely interdependent that conflicting results are often obtained and accepted control measures sometimes fail.

Jones (K. L.). **Further notes on variation in certain saprophytic Actinomycetes.**—*J. Bact.*, li, 2, pp. 211–216, 5 figs., 1946.

Variation in certain saprophytic soil Actinomycetes on a synthetic medium has already been reported (*Proc. Soil Sci. Soc. Amer.*, v, pp. 255–258, 1940). Since then observations have accumulated at the University of Michigan on the effects of various factors on this process. When freshly isolated, the entire range of types is secured, irrespective of the colony selected for inoculum, but the frequency of types may be affected by the amount of inoculum and by continued selection. Prolonged subculturing on laboratory media leads to the modification or loss of the following characteristics: (1) thickness, surface, margin, and texture of the mycelium as viewed macroscopically; (2) growth rate; (3) presence or absence of aerial hyphae and conidia; (4) distribution of these organs; (5) deliquescence on the surface of the growth; (6) presence or absence of pigments; (7) type of colour; and (8) rate of calcium malate and starch digestion. At least partial restoration of the original distinguishing features of the several strains may be effected by culturing on sterilized soil.

Castellani (E.). **Su due malattie del Cartamo osservate nell' altopiano etiopico.** [On two diseases of *Carthamus* observed on the Ethiopian plateau.]—Reprinted from *Agricoltura colon.*, xxxiv, 8, 10 pp., 8 figs., 1940. [Received February, 1946.]

Carthamus tinctorius growing on the Ethiopian plateau was observed to be affected by rust (*Puccinia carthami*) [*R.A.M.*, xxiv, p. 4]. The uredosori, mostly found on the lower surface of the leaf blade, measured 0·33 to 0·46 mm. in diameter, the uredospores 21 to 26 by 19 to 22·5 μ, the teleutosori (also on the lower surface) 0·6 to 0·8 mm. in diameter, and the teleutospores (mostly uniseptate) 25 to 28 by 30 to 35 μ. No pycnidia or aecidia were observed.

The same host was also attacked by leaf spot (*Cercosporella carthami*) [ibid., vi, p. 355]. Infection began when the plants were one month old, and became very severe during flowering, attacking the leaves (especially those nearest the ground) and occasionally the bracts and stem. Small spots, 2 to 30 in number, pale at the centre and surrounded by a dark green halo, with a well-defined edge, appeared scattered over the leaf blade. At first visible only by transparency the spots later became yellow, then dark brown. The interveinal ones were round, while those

near the edges or the principal veins were semicircular, polygonal, or irregular. Each spot showed a small, pale central area surrounded by a halo up to 1 mm. wide, becoming light yellow, later dark. On heavily infected leaves this halo was inconspicuous, its colour merging into that of the leaf, which also became light yellow, then dark, the leaf surface being covered with numerous necrotic spots. In very severe attacks, the leaf margins became contorted and the spots cracked. Many leaves dropped, the photosynthetic activity of those remaining became greatly reduced, and seed production was much diminished. Infection was favoured by wet seasonal conditions.

The fungus showed mostly simple, occasionally branched, erect or slightly curved conidiophores measuring 75 to 150 by 3 to 4 μ, and bearing acrogenous or acropleurogenous, hyaline, subclavate, 0- to 5- (2- to 3)-septate conidia measuring 30 to 75 by 3·6 to 6·5 μ, readily germinating in damp conditions, and sometimes briefly catenulate. The conidiophores emerged in tufts of 12 to 20 through the stomata, and in very wet conditions, directly through the leaf epidermis, generally from substomatic stromata though sometimes from light, barrel-shaped cells of the stromata. No control measures are indicated against the rust; against *C. carthami* spraying with Bordeaux mixture containing 1 per cent. of copper sulphate is advised.

CASTELLANI (E.). **Il vaiolo del 'Cossò'.** ['Cosso' leaf spot.]—Reprinted from *Agricoltura colon.*, xxxvii, 5, 6 pp., 2 figs., 1943. [Received February, 1946.]

During 1937, a group of *Hagenia* [*Brayera*] *abyssinica* (syn. *B. anthelmintica*) plants [cultivated in Abyssinia for use as an anthelmintic], growing in a rather damp depression near Amba Gheorghis, Amara, showed numerous small, round or polygonal spots on the leaves and stipules. The centres were light yellowish, but later became necrotic, and were surrounded by an irregular, anthocyanic halo up to a few mm. wide. The spots frequently became confluent, sometimes involving half the leaf blade. On the lower and, very occasionally, the upper leaf surface, erumpent acervuli developed on the spots and contained numerous hyaline, cylindrical, straight or more often curved, sometimes geniculated conidia 32 to 45 by 2·5 to 4 (3) μ, and 0- to 4-septate, which emerged as a whitish, subgelatinous mass.

The author regards the fungus as a new species of *Phleospora*, which he names *P. hageniae* n.sp. A Latin diagnosis is expected to appear later.

LINDEGREN (C. C.). **Yeast genetics: life cycles, cytology, hybridization, vitamin synthesis, and adaptive enzymes.**—*Bact. Rev.*, ix, 3–4, pp. 111–170, 7 figs., 8 diags., 1945.

In addition to the aspects of yeast genetics mentioned in the title, this paper deals with mating types, cultural variability and stability, spores and sporulation, speciation in yeasts, budding, structure of the colony, and dormancy. A bibliography of 83 titles is appended.

MCCUBBIN (W. A.). **Preventing plant disease introduction.**—*Bot. Rev.*, xii, 2, pp. 101–139, 1946.

This is a very comprehensive and useful review of 89 papers, many of which have already been noticed from the original sources, dealing with legislative measures for the exclusion of plant diseases from the United States [*R.A.M.*, xxiv, p. 461]. The aspects of the problem discussed include the reality and costliness of foreign disease introductions, effectiveness of quarantine measures, special relations of contiguous land areas, natural channels for the introduction of plant pathogens, introduction through human activities, relation of biological races to disease introduction, natural barriers to disease introduction, factors affecting national efforts to prevent disease introduction, programme and procedures of disease exclusion, and the role of the foreign certificate.

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McMARTIN (A.). **Fungicidal treatment of Sugarcane cuttings. A practical success.**—*S. Afr. Sug. J.*, xxx, 2, pp. 71, 73, 75, 3 figs., 1946.

A survey is given of the results achieved to date by the treatment of sugar-cane cuttings in Natal with fungicides against pineapple disease [*Ceratostomella paradoxa*: *R.A.M.*, xxv, p. 279] and other organisms. The following facts, in addition to information already presented, may be of interest. Verdasan, formerly applied at the same rate as aretan (1 lb. per 20 gals. water), has since been found effectual at a much lower dosage, viz., 6 oz. per 20 gals. The other mercurials, ceresan, agrosan, and abavit, should be used at a dosage of 2 lb. to produce comparable results. An instantaneous dip of the ends of the canes, tied in bundles, in a few inches of the disinfectant is all that is required to ensure effective control, but some growers find it more economical in labour to immerse the bundles completely in tanks and then place them on draining racks.

The amount of aretan (the preparation most commonly employed) necessary per acre is very variable. The lowest figure of 1 oz. was obtained in experimental plots with stripped cane of medium diameter and single-stick planting. On the field scale, 2 oz. may suffice for thoroughly cleaned cane, but 4 oz. would be a more usual dosage for moderately clean material, while for cane with adhering trash ½ lb. per acre is an appropriate rate. Data collected from large-scale plantings give an average figure of 4 to 5 acres per lb. aretan for the Co. 281, 301, and 331 varieties, with trashed to semi-trashed cane planted with an overlap, and 2 acres for un-trashed, double-stick planting. Under normal conditions the cost per acre for aretan should work out at 1*s*. 9*d*. to 3*s*. 6*d*.

PRÉVOT (A. R.). **Études de systématique bactérienne. VII. Actinomycetales.** [Studies on bacterial taxonomy. VII. Actinomycetales.]—*Ann. Inst. Pasteur*, lxxii, 1–2, pp. 2–11, 1946.

The interests of structural homogeneity of families and genera, as well as the need for a differentiation between Gram-negative and Gram-positive groups of bacteria, are deemed to require a reclassification of the Actinomycetales [*R.A.M.*, xxiii, p. 150], and the author accordingly proposes the following scheme: Class Actinomycetales; orders (1) non-acid-resistant, Actinobacteriales new order, comprising the families of Gram-negative Sperophoraceae Prévot and Gram-positive Actinomycetaceae Buchanan, and (2) acid-resistant, Mycobacteriales new order, represented by a single family Mycobacteriaceae Chester 1901. Five genera are included in the Sperophoraceae, while the Actinomycetaceae comprise *Actinomyces*, *Proactinomyces*, *Corynebacterium*, *Actinobacterium*, *Bifidibacterium*, and *Erysipelothrix*. *Mycobacterium* Lehmann and Neumann 1896 is the only genus of the Mycobacteriaceae.

Langdon (R. F.) & Herbert (D. A.). **Records of Queensland fungi. IV.**—*Pap. Univ. Qd*, ii, 4, 4 pp., 1944. [Received May, 1946.]

In this further annotated list of 25 Queensland fungi [cf. *R.A.M.*, xvii, p. 70] mention may be made of *Diorchidium tricholaenae* on red Natal grass (*Rhynchelytrum repens*), almost certainly a South African introduction; *Uromyces orientalis* on *Indigofera linifolia*; and *Urocystis gladioli* on Picardy *Gladiolus* [ibid., xxi, p. 258]. The last-named is believed to be widespread in Australia, where (in all probability) the diseased corms were grown owing to war conditions.

Stapp (C.) & Marcus (O.). **Serologische Untersuchungen am Tabak über Ausbreitung und Verteilung der 3 Kartoffelviren X, Y und A.** [Serological investigations on Tobacco concerning the extension and distribution of the three Potato viruses X, Y, and A.]—*Zbl. Bakt.*, Abt. 2, cv, 20–22, pp. 369–405, 44 diags., 1943. [Received May, 1946.]

The presence of all three potato viruses, X, Y, and A, severally and together, could be detected in Samsun Bashi Bagli tobacco with the aid of the precipitin-drop (sero-micro-method). As sole occupant of the plant, the X virus spread more rapidly than either of the others. If X was already present in the host before the advent of Y, the extension and multiplication of the latter was still further markedly delayed, whereas A under comparable conditions made better headway. The combination of Y and A did not hinder the progress of either component to any appreciable degree. The simultaneous inoculation of plants with all three viruses led in some cases to pronounced delay in their diffusion.

Foliar symptoms and stunting of the plants were most conspicuous when X and Y or X and A entered simultaneously and A or Y was added later, i.e., when infection was initiated by the mild virus and carried on by a severe one.

Portions of the stem were often virus-free, an observation interpreted as confirmatory of Köhler's assumption of discontinuous migration [cf. *R.A.M.*, xvii, p. 561]. The early detection of infection in the roots seems to point to rapid transport through the phloem over considerable distances. No virus was found in the seeds of mature plants inoculated with X at an early stage of development. The maximum virus concentration within the host was attained by X and the minimum by Y.

Various hypotheses are advanced and briefly discussed in explanation of the discovery in apparently healthy leaves of one or more viruses, and their absence from foliage showing symptoms of varying intensity.

Steinberg (R. A.). **A 'frenching' response of Tobacco seedlings to isoleucine.**—*Science*, N.S., ciii, 2672, pp. 329–330, 1946.

Isoleucine at dosages of 50 to 20 p.p. mille in the culture medium used for the growth of tobacco seedlings at the Bureau of Plant Industry, Beltsville, Maryland, induced various abnormalities in the plants, including loss of dominance of the apical bud, production of numerous narrow leaves, and mottled chloroses. The shortened stem and profusion of axillary buds resulted in a 'witches' broom' growth habit. These features are characteristic of 'frenching' disease, which may also be simulated by plants suffering from sulphanilamide (*Amer. J. Bot.*, xxvi, p. 14, 1939) or thallium toxicity [*R.A.M.*, xviii, p. 716; xix, p. 499]. The extreme environmental conditions employed for the tests, i.e., very high moisture and relative humidity, low light intensity, and the substitution of agar for soil, resulted in slight deviations from the typical symptoms of frenching in the field. For instance, the foliar mottling did not assume the characteristic reticulate pattern and the narrow or strap leaves were not conspicuously erect, nor did they show much indication of marginal undulations or ruffling. None of the other amino acids, sugars, vitamins, or peptones tested (60 or so in all) caused comparable anomalies of growth.

Terrier (C.). **La maladie des Ormeaux.** [The disease of young Elms.]—*Bull. Murith.*, lxii, pp. 71–84, 5 figs., 1944–45.

After stating that elm trees in parts of central Valais, Switzerland, are seriously affected by *Ophiostoma* [*Ceratostomella*] *ulmi* [*R.A.M.*, xxiv, p. 344], particularly at Savièse and at St-Pierre-de-Clages, and also along the right bank of the Rhône from Saillon to Loèche, the author gives a full account of the disease, including its symptoms, transmission, geographical distribution, economic importance, and control. Reference is also made to varietal resistance and secondary hosts, and there is a bibliography of 28 titles.

Régnier (R.). **Le chancre suintant et les différents types de Peupliers.** [Running canker and the different types of Poplar.]—5 pp., Académie d'Agriculture de France, 1943. [Received February, 1946.]

In an endeavour to find poplar varieties resistant to bacterial canker [*R.A.M.*, xviii, p. 68; xxiv, p. 210] an experimental plantation of poplars was established in 1931 near Noyon, France. The following species were found to be resistant or immune: *Populus simonii*, $\times$*P. eugenii*, $\times$*P. berolinensis*, and $\times$*P. gelrica*; those which were generally resistant were *P. nigra*, *P. monilifera*, *P. virginiana*, primary hybrids, e.g., $\times$*P. serotina* and its varieties, and secondary female hybrids, e.g., $\times$*P. marilandica* and its variety *laevigata*. The most susceptible were *P. candicans*, some of the offspring of $\times$*P. generosa* (others were immune), secondary and tertiary hybrids of black poplars and female regenerated poplars ($\times$*P. regenerata*) from infected areas. Many hybrids are still under trial.

P. candicans and $\times$*P. regenerata* must therefore be completely eliminated from localities where the disease is intense. In areas where infection is absent or only slight $\times$*P. regenerata* may be grown provided it is multiplied locally and subjected to careful control. Healthy *P. candicans* trees from unaffected localities may be planted in isolated, mountainous areas. Strenuous prophylactic measures are essential. The despatch of trees to unaffected areas should be closely watched, and that of susceptible and untested types should be forbidden. In the vicinity of the original areas of infection, and everywhere else in the department, the poplars, other than *P. candicans* and regenerated, are unaffected. Plantations should be cleaned up and diseased trees cut down for firewood.

Gäumann (E.). **Influence de l'altitude sur la durabilité du bois de Mélèze.** [The effect of altitude on the durability of Larch wood.]—*Bull. Murith.*, lxii, pp. 47–52, 5 graphs, 1944–45.

When the heartwood of larch (*Larix decidua*) from 75 trees aged from 75 to 360 years and grown at all altitudes from 460 to 2,100 m. above sea-level in the canton of Grisons, Switzerland, was experimentally exposed to infection by *Polyporus vaporarius* [*Poria vaporaria*] under conditions of constant temperature and humidity (the selected trunks being of commercial dimensions and their humidity the same as in forest conditions), it was found that the average loss in dry weight due to rotting in trees growing at an altitude of 1,050 to 1,750 m. was only two-thirds of that in those grown outside that range. Attention is drawn to the fact that these figures hold good only for the locality concerned.

Boudru (M.). **La maladie des pousses du Pin noir d'Autriche. Brunchorstia destruens Eriksson.** [The shoot disease of Austrian black Pine. *Brunchorstia destruens* Eriksson.]—*Bull. Soc. for. Belg.*, liii, 1–2, pp. 2–14, 9 figs., 1946.

In this account of the disease of *Pinus* spp. caused by *Brunchorstia destruens* [*R.A.M.*, xi, p. 757; xxiii, p. 200] the author states that the most susceptible variety is Austrian black pine (*P. nigra* var. *austriaca*). He has observed the disease

on a five-year-old *P. resinosa*, and it has also been reported in Belgium on one-year-old seedlings and transplants of Austrian black pine. Infection becomes less severe on trees over 40 years old. Instances of the association of other parasitic diseases with *Brunchorstia* suggest that the latter may behave as a weak or secondary parasite. Under Belgian conditions the only control necessary is the repeated removal of dead and severely affected trees. Infected materia l should be burnt.

FRITZ (CLARA W.). **Does depth influence rate of decay in mine timber?**—*Canad. Min. J.*, lxiii, 11, pp. 719–720, 1942.

Merulius lacrymans was found to be the principal agent of decay in timbers at the upper levels of the mine of the Kirkland Lake Gold Mining Company, Ltd., Ontario. The fungus is excluded from the 5,400 ft. level by the prevailing high temperatures (76° to 80° F.), while other fungi were prevented from developing on these timbers by the dryness of the wood. It is concluded that depth influences timber decay only by the provision of environmental conditions favourable or otherwise to the fungi introduced into the mine.

Report on a visit to Dr. Wolman, Wood Preservation Specialist, Bad Kessingen.—Final Report No. 216, British Intelligence Objectives Sub-Committee, pp. 5–6, London, H.M. Stationery Office, [? 1945. Mimeographed.]

Dr. Wolman, in an interview on 31st October, 1945, described the pre-war wood-preservation situation in Germany as follows. Creosote and Wolman salts [triolith: *R.A.M.*, xxii, pp. 189, 464; xxv, p. 242] were the chief preservatives, 75 per cent. of ties having been treated with the former and 25 per cent. with the latter. The absorption of creosote is about 63 kg. per cu.m. by the Rueping process, and that of 2 per cent. Wolman salts 200 kg. Beech was used for 25 to 35 per cent. of the material and pine for the remainder. Oak was often used for cross-track ties. About half the spruce or pine poles were treated with either of the two preservatives. Only pressure treatments were used for creosote, while triolith was applied by the Boucherie or open-tank processes. Some 95 per cent. of mining timbers were treated with triolith.

During the war the only preservative available in the country was zinc chloride, the use of which had been discontinued 40 years previously owing to its corrosive action on iron. Full-cell pressure treatments were given, involving an absorption of 16 kg. of the dry salt per cu.m.

Dr. Wolman thought it improbable that creosote would be extensively used for wood preservation in the future in Germany, since its price is RM. 0·05 per kg. and the substitute for diesel oil obtained from it sells at RM. 0·18. Its place will presumably be taken by triolith.

Old ties have been salvaged by Dr. Bäseler, of the State Railways Administration, by removing the rotted portions and glueing together the sound pieces with tego-film, kaurit, or other synthetic water-proof adhesives. The glue is set by the heat generated by the passage of an electric current through wires embedded in the joint.

NAGEL (C. M.). **Epiphytology and control of Sugar Beet leaf spot caused by Cercospora beticola Sacc.**—*Res. Bull. Ia agric. Exp. Sta.* 338, pp. 680–705, 1 fig., 1 diag., 8 graphs, 1945.

The experiments on which this report is based relate to the years 1933 to 1937, inclusive, and are concerned with the effect under Iowa conditions of different spacing widths on beet leaf spot (*Cercospora beticola*) development, acre yield, and sucrose content [*R.A.M.*, xvii, p. 719]. In 1933, 1934, and 1937, under conditions of moderate infection, the disease was less injurious to the foliage in the wider spacing

(21 × 21, 24 × 24, and 28 × 28 in.) than in the narrower (12 × 12, 12 × 21, 14 × 14, 18 × 18, 12 × 24 in.) In the wet season of 1935, which was marked by a severe epidemic of leaf spot, the plants in all the spacings sustained heavy damage. On the other hand, in 1936 the dry weather almost entirely prevented the development of infection, and the differences in plot yields were attributed partly to this factor and partly to the various spacings. With the possible exception of the 21 × 21 in. spacing in 1937, the yields did not differ significantly in the spacings commonly used in practice, viz., 12 × 21, 18 × 18, and 21 × 21 in. The virulence of the pathogen tended to be enhanced with an increase in the number of plants per hill from one to four. In each year wider spacings produced larger beets than the closer ones, though the acre yield of the former was usually lower. The steady increase in size of the beets with an increase in spacing remained fairly steady regardless of the season or intensity of leaf spot, and in one season was sufficient to give a yield equal to or more than that of smaller beets at closer spacings. The use of doubles at wide spacings appears to be a practical method of cultural control, since there is some reduction in leaf spot and the doubles may, under commercial conditions give a greater yield, since the complete loss of hills so frequent in machine culture would undoubtedly be less when doubles are left rather than singles. The differences in sucrose percentage in the several spacings and number of plants per hill were negligible.

HUCKETT (H. C.). **Timing rotenone applications for control of the Pea aphid on Long Island, with special reference to mosaic incidence.**—*Bull. N.Y. St. agric. Exp. Sta.* 713, 29 pp., 8 figs., 1945.

The difficulties of pea-growers on Long Island appear to be conditioned largely by climatic conditions in relation to the wind-borne dissemination of the pea aphid, *Macrosiphum pisi*, and the incidence of the pea mosaic virus [*R.A.M.*, xvi, p. 83] with which it is associated.

A single application of rotenone when plants were beginning to flower increased the average yield by 26·9 per cent. over the controls, and the number of plants apparently infected was reduced from an average of 17·7 per cent. in untreated plots during 1941, 1943, and 1944 to 9·3 per cent. In comparison two to five applications were followed by an increased yield of 25·8 to 32·4 per cent. over untreated plots and the number of apparently infected plants fell to from 6·9 to 11 per cent. The adverse effect of high temperatures and strong winds is reflected in the relatively small increase in control given by several applications over that given by one or two.

PRICE (W. C.). **Purification and crystallization of southern Bean mosaic virus.**—*Amer. J. Bot.*, xxxiii, 1, pp. 45–54, 5 figs., 1946.

This is an expanded account of the writer's work in connexion with the purification and crystallization of the southern bean mosaic virus, a preliminary note on which has already appeared [*R.A.M.*, xxiv, p. 397]. The purified material appeared homogeneous when examined in an analytical centrifuge, electrophoresis and diffusion apparatus, and an electron microscope. Such preparations reacted positively to tests for protein and negatively to those for carbohydrate, and contained spherical particles with a mean diameter of 33·6 mμ. They maintained their activity for months at 3° C. but rapidly lost it when frozen (−10°): in one test 95 per cent. of the infectivity of a purified sample disappeared in six days, 98·4 per cent. in 11, and complete inactivation was effected in three months. Solutions of the crystallized material, consisting either of rhombic bipyramids joined by two pinacoids or rhombic prisms, were highly active and induced typical southern bean mosaic symptoms on Early Golden Cluster and Scotia beans (*Phaseolus vulgaris*), Lima beans (*P. lunatus*), and soy-beans.

Price (W. C.). **Accuracy of the local-lesion method for measuring virus activity. IV. Southern Bean mosaic virus.**—*Amer. J. Bot.*, xxxii, 10, pp. 613–619, 1 fig., 1 graph., 1945.

Continuing his experiments in the measurement of the activity of virus diseases [*R.A.M.*, xxiii, p. 152], the author presents the results when similar procedures were adopted in calculating the activity of southern bean mosaic virus [see preceding abstract].

A preliminary experiment in which leaves of Early Cluster bean (*Phaseolus vulgaris*) plants were inoculated with a range of dilutions of the virus (the stock being obtained by three different methods) established that a dilution curve must be obtained for each experiment from the data, two or more dilutions being used to determine its slope. An assumption of unit slope introduces error. Local lesions caused in 18 Early Golden Cluster bean plants by two dilutions of purified virus preparation specified as standard were compared with those caused by two other dilutions designated as of unknown strength. Each plant had two leaves; one half of one leaf was rubbed with the first standard dilution and the other half with the corresponding unknown; the second leaf was used for the second pair of dilutions. The lesions were counted after five days. It was shown that the activity of the virus could be measured with an error seldom exceeding 10 or 15 per cent. when the proper concentration of the unknown and the standard were used. Moreover, where dilutions are chosen so that the unknown is about 25 per cent. of the standard in one case, and 50 per cent. in the other, it is 0·95 probable that the estimate will not differ from the true value by more than 40 per cent. on the one hand and 20 per cent. on the other. The accuracy was greater when the two concentrations tested differed by only 50 per cent. instead of 75 per cent., while the standard error of the estimate, which may be computed from the data, indicated the error of measurement fairly accurately.

Boswell (V. R.). **Disease resistant and hardy varieties of vegetables.**—*Nat. hort. Mag.*, xxv, 2, pp. 158–164, 1946.

In this fifth and final instalment of his survey of the present position of vegetable-breeding for disease resistance and hardiness in the United States [*R.A.M.*, xxv, p. 151], the author discusses recent developments in the selection of lettuce for resistance to downy mildew [*Bremia lactucae*]; peas capable of withstanding wilt (*Fusarium* [*orthoceras* var. *pisi*]) and other fungi and viruses; root crops (beet, carrot, parsnip, radish, turnip, and swede), which do not, in general, vary greatly in their reactions to pathogenic agencies, except in the case of beet curly top virus; and spinach for resistance to 'blight' or mosaic [cucumber mosaic virus].

Chowdhury (S.). **A Rhizoctonia leaf blight of Dioscorea.**—*Curr. Sci.*, xv, 3, pp. 81–82, 1 fig., 1946.

A species of yam, *Dioscorea alata*, cultivated in Sylhet, Assam, for its edible tubers, was severely attacked in July, 1944, by *Rhizoctonia* [*Corticium*] *solani*, which caused a leaf blight characterized by the radiation from an infection centre of alternating light and dark brown, concentric zones. Following the collapse of the initially infected basal leaves, the pathogen spread down the petiole to the stem, involving the rest of the foliage in its progress. Scattered strands of coarse mycelium were often observed traversing the surfaces of badly blighted leaves, and microscopic examination further revealed the presence of small stromatic areas or 'infection cushions', which were described by Duggar [for *Helicobasidium purpureum*] (*Ann. Mo. bot. Gdn*, ii, pp. 403–458, 1915) as of material assistance in the process of penetration and apparently serving as a fulcrum for the intrusion of the hyphae through the uninjured epidermal cells. The 'cushions' were formed on both surfaces of all inoculated leaves, irrespective of the position of the stomata,

and marked symptoms of infection developed within four or five days. This is the first record of *C. solani* on the host under observation.

Ciferri (R.). **Le malattie della Manioca ('Manihot esculenta' Crantz) in San Domingo. III. Identità e nomenclatura delle 'Cercospora' viventi sulle 'Manihot'.** [The diseases of Cassava (*Manihot esculenta* Crantz) in San Domingo. III. Identity and nomenclature of the *Cercospora* species living on *Manihot* plants.]—*Boll. Staz. Pat. veg. Roma*, N.S., xx, pp. 99–114, 5 pl., 2 figs., 1940. [Received February, 1946.]

Continuing his study on cassava (*Manihot esculenta* = *M. utilissima*) diseases in the Dominican Republic [*R.A.M.*, xiii, p. 147], the author states that he found two distinct species of *Cercospora* on this host there, one causing small, dry, whitish spots, usually present in large numbers on every segment of the leaf and found all through the year wherever cassava was grown, and the other producing large, damp, diffuse, greyish or brownish spots, of which only one was present, as a rule, on each leaf segment; these spots were observed only in the wet season. From a detailed study of the subject, including an exhaustive review of the literature, he concludes that the organism causing the first disease is *C. henningsii* Allescher in P. Henn., Die Pflanzenwelt Ostafrikas, Teil C, p. 35, 1895, with which the following are considered to be synonymous: *C. cassavae* Ell. Ev.; *C. manihotis* P. Henn., 1902; *C. manihotis* P. Henn., 1907; *C. cearae* Petch; *C. manihoticola* Stev., 1923, ined. [nom. nud.]; *Septogloeum manihotis* Zimm.; *Cercosporella pseudoidium* Speg. non. Cif. The fungus causing the second disease is *Cercospora caribaea* Chupp & Cif., Mycofl. Domingens. Exs. 12 1931 [nom. nud.]; Chupp in Müller & Chupp, 1935 [*R.A.M.*, xv, p. 59], with which the following are regarded as synonymous: *C. henningsii* auct. plurib. (incl. Cif. *Ann. mycol., Berl.*, xxix, p. 290, 1931) non Allescher; *C. cearae* Chupp in Chardon & Toro, 1930, non Petch; *Ragnhildiana manihotis* Stev. & Solh.; and *Corynespora manihotis* Solh., ined. (*in litt.*, 1932).

Levadoux (M. L.). **Le Brenner (Pseudopeziza tracheiphila Müll.—Thurg.).** [Brenner (*Pseudopeziza tracheiphila* Müll.-Thurg.).]—12 pp., 2 figs., Imprimerie du Bulletin de l'Office International du Vin, Alençon (Orne), 1944. [Received February, 1946.]

The author gives a clear, succinct account in semi-popular terms of the history, symptoms, effects, progress, and control of vine 'brenner' (*Pseudopeziza tracheiphila*) [*R.A.M.*, viii, p. 701; xx, p. 515; xxiii, p. 208], based largely on the literature of the subject. The disease is of long standing in the east-central and north-eastern regions of France, where, however, since the introduction of cupric spraying [against *Plasmopara viticola*] it seldom causes serious loss. It occurred in 1944 [? in the vicinity of Montpellier].

Stanley (W. M.), Knight (C. A.), & De Merre (L. J.). **Actualités médico-chirurgicales. VI. Les virus. Études biochimiques et biophysiques récentes.** [Medico-surgical topics of to-day. VI. Viruses. Recent biochemical and biophysical studies.]—81 pp., 4 figs., Bruxelles, Fondation Francqui, & New York, Belgian-American Educational Foundation, Inc., 1945.

This brochure is one of a series prepared for the use of the medical profession in Belgium edited and prefaced by Dr. E. J. Bigwood. A clear and succinct review is presented of the work done, particularly by British and American investigators, during the past five or six years on virus diseases. The ground covered comprises the physico-chemical properties of viruses (composition and structure, dimensions and forms, bi-refringence, effects of various chemical and physical agents, extraction and purification) and their biological properties (synthesis and multiplication,

transmission, virus complexes, serological studies, inclusions, and quantitative determination methods). The bibliography extends to 336 items. The clinical aspects of the subject are reserved for a later publication.

Compte rendu sommaire des travaux des stations et laboratoires de pathologie végétale en 1940. [Brief report on the work of the plant pathological laboratories and stations in 1940.]—*Ann. Épiphyt.*, N.S., vii, 2, pp. 135–142, 1941. [Received April, 1946.]

During 1940 vine mildew (*Plasmopara viticola*) [*R.A.M.*, xxiv, p. 490; xxv, pp. 59, 94, *et passim*] was very severe in south-western France. The vines at the Agronomic Centre were sprayed on 7th and 22nd May, 4th and 17th June, and 1st and 16th July, and on 21st July were given a dust application against brown rot. The first treatment was not very effective, the second gave good results, the third was of secondary importance as regards foliage protection, but kept the bunches free from grey rot [*Botrytis cinerea*], and the fourth was of prime importance, every vine which failed to receive it subsequently having its entire crop affected; the same applied to the fifth, and the sixth was also indispensable, vines not receiving this application later having nearly all their leaves affected; the final dusting arrested brown rot.

In many parts of the Bordeaux area *Oidium* (*Uncinula necator*) [ibid., xxiv, pp. 50, 490] caused heavier losses than *P. viticola*. The disease seems to grow worse every year, locally.

At Bordeaux peach scab, apparently caused by a fungus closely resembling *Fusicladium amygdali*, was observed for the first time.

Further work was carried out at Clermont on forecasting outbreaks of potato late blight (*Phytophthora infestans*) [ibid., xvi, p. 514; xviii, p. 814], diseased tubers being planted among healthy ones at different observation posts, and three susceptible varieties maturing at different dates (Bintje, Early Rose, and Saucisse) being used. At Clermont-Ferrand rain between 9th and 15th July induced primary infection; the atmospheric humidity remaining at 100 [per cent.] for 28 hours and the average temperature at 14°[C.]. At Antibes the disease developed with great intensity on late tomatoes and potatoes. The passage of the disease from potatoes to tomatoes under glass in the vicinity was observed.

Compte rendu sommaire des travaux des stations d'avertissements agricoles. [Brief report on the work of the agricultural forecasting stations.]—*Ann. Épiphyt.*, N.S., vii, 2, pp. 147–152, 1941. [Received April, 1946.]

Most of the items of information contained in this report have already been noticed [see preceding abstract].

Rapport sommaire sur les travaux poursuivis en 1940 par les stations d'amélioration des plantes. [Brief report on the work carried out in 1940 by the plant improvement stations.]—*Ann. Épiphyt.*, N.S., vii, Numéro spécial, pp. 143–156, 1941. [Received April, 1946.]

During 1940 wheat varieties growing at the Clermont-Ferrand Plant Improvement Station were subjected to a severe outbreak of *Puccinia graminis*, but Picardie, Préparateur Étienne, and Blé des Dômes showed only slight infection. The last-named, previously known as C.F.I., derives from K8 × Szekacs. It is very resistant to cold, early, of excellent grain quality and shows good resistance to *P. graminis* and yellow rust [*P. glumarum*].

Comparative tests carried out since 1935 showed that Probstdorf winter barley was outyielded only by Hâtif de Grignon, which, however, is more susceptible to lodging and very susceptible to smut (*Ustilago nuda*), while the quality of its grain is much inferior.

Flax at Versailles was severely attacked by anthracnose (*Colletotrichum lini*) but the varieties Gilliland, Szekacs, and Tataras showed relatively little damage.

LEPIK (E.). **Pflanzenpathologie im Ostland. II. Mitteilung. Ein Beitrag zur Kenntnis wenig bekannter Pflanzenkrankheiten aus Estland.** [Plant pathology in the Ostland. Note II. A contribution to the knowledge of little known plant diseases from Estonia.]—*Zbl. Bakt.*, Abt. 2, cvi, 5–7, pp. 89–93, 4 figs., 1943. [Received May, 1946.]

This second note on phytopathology in the 'Ostland' [cf. *R.A.M.*, xxii, p. 263; xxv, p. 63] is a disease survey of Estonia for 1942, and includes the following items.

Lilac (*Syringa vulgaris*) showed fairly heavy infection by *Phyllactinia suffulta*.

Plantings of *Taraxacum kok-saghyz* introduced at the time of the Russian occupation suffered intensive injury from *Botrytis cinera*, causing premature collapse and complete decay of the inflorescences.

Cercospora concors, seldom observed in Germany, is widespread in Estonia, where it is responsible for substantial damage to the potato crop; in 1942 up to 100 per cent. of the leaves were infected in a number of localities. *C. dubia* [ibid., xiv, p. 195], an uncommon parasite of *Atriplex hortensis*, produced large spots and shrivelled zones on the foliage.

Three unusual species of *Colletotrichum* were also in evidence during the period under review, viz., *C. pisi* on peas, *C. solanicolum* [*C. atramentarium*] on potato, and *C. spinaciae* on spinach [ibid., xix, p. 189]. Among the late potato varieties attacked by *C. atramentarium* were Deodora, Jubel, Jögevaer Stärkereiche Blaue, Lorch, and Majestic. Contrary to statements in the relevant literature, the fungus was found not only on the underground stems but also on the aerial organs. *C. spinaciae* destroyed up to 80 per cent. of the spinach crops in the vicinity of Dorpat, interfering considerably with seed production.

Phoma solanicola, only once reported from Germany [ibid., vii, p. 667], was fairly prevalent in Estonia in 1942, especially on late potato varieties, almost invariably in association with *C. atramentarium*. The former produces large, blackish-brown lesions on the stems and petioles, which rapidly wither.

Septoria ribis [*Mycosphaerella grossulariae*: ibid., xii, p. 640; xxiii, p. 43] occurred in a virulent form on black currants, the small, sunken areas developing into cracks and involving the total collapse of the fruits.

WHITE (N. H.). **Plant disease survey of Tasmania for the three year period 1943, 1944, 1945.**—30 pp., 1 map, Tasmanian Department of Agriculture. [? 1946. Mimeographed.]

This first comprehensive survey of plant diseases in Tasmania includes the following new records for the State. Heavy losses were caused in the black currant crop during 1943 by *Septoria ribis* (*Mycosphaerella ribis*) [*M. grossulariae*: see preceding abstract], which is present in every currant garden in Southern Tasmania. Previously the currant crops received no fungicidal spray, but it has now become necessary to give three Bordeaux applications. Burial or burning of fallen leaves will eliminate the *Mycosphaerella* stage. Black currants are more severely affected than red. Two cases of strawberry leathery rot (*Phytophthora cactorum*) [*R.A.M.*, xix, p. 26] occurred at Launceston. Northumberland and Fill-basket raspberries were susceptible to *Phragmidium rubi-idaei*.

Ring spot (*M. brassicicola*) [ibid., xxii, p. 335] occurred each year in autumn on cauliflowers and cabbages at Summerleas, Hobart, and Launceston, causing heavy damage to one cauliflower crop. Cauliflowers, cabbages, broccoli, and Brussels sprouts in all parts of Tasmania were attacked each year in November, December, and January by light leaf spot (*Gloeosporium concentricum*) [ibid., xix, p. 449].

Ring spot (*Marssonina panattoniana*) [ibid., xxiii, p. 474] in September, 1945, attacked crops of outdoor winter lettuces, one at Launceston and another at Hobart, during rainy weather. Two cases of crinkle mosaic of onions (*Allium* virus 1) [onion yellow dwarf: ibid., xix, p. 511; xxiv, p. 486] occurred, at Glenorchy and Moonah. In March, 1944, parsnips at Scottsdale, Margate, and Hayes were attacked by leaf spot (*Ramularia pastinacae*) [ibid., xviii, p. 413; xxiv, p. 5]. Chantenay carrots were very susceptible to mosaic, while Osborn pink and a Manchester selection were highly tolerant. Vetomold tomato was susceptible to *Cladosporium fulvum* [cf. ibid., xxiii, p. 474 *et passim*]. Goldthorpe barley showed 5 per cent. infection of ergot [*Claviceps purpurea*].

Potatoes were attacked from January to April each year by pink rot (*Phytophthora erythroseptica*) [ibid., xx, p. 32; xxiv, p. 491]; the disease appears to have been present for a long time, though not previously recognized. One potato tuber showed charcoal rot (*Sclerotium bataticola*) [*Macrophomina phaseoli*: ibid., xxiii, p. 455].

Antirrhinum scorch or shot hole (*Heteropatella antirrhini*) [ibid., xvii, p. 824] was very severe on second-year plants in gardens and among seed crops in August and September of each year in and round Hobart. Large numbers of plants were killed. *Delphinium* plants (seed crops) at Hayes and Margate showed bacterial tarry blotch (*Pseudomonas delphinii*) [ibid., xiii, p. 356]. Storage rot of *Gladiolus* corms (*Botrytis gladioli*) [ibid., xx, p. 364] was effectively controlled by de-scaling ten days after digging and then treating with tetroc or spergon. *Gladiolus* mosaic (*Cucumis* virus 1) [cucumber mosaic virus: ibid., xxiii, p. 488] caused blotching of flowers especially in Picardy, and running-out of corms. Leaf scorch of daffodils [*Narcissus pseudo-narcissus*] and jonquils [*Narcissus jonquilla*] due to *Stagonospora curtisii* [ibid., xxiii, p. 79] occurred in some gardens in November.

In his concluding paragraphs the author briefly refers to the unusual weather conditions experienced during the period under review and also points out that although only 4 per cent. of the diseases recorded were due to viruses, more than half the economic losses sustained were caused by virus attacks. Bacterial diseases also caused serious economic loss.

Divisions of Plant Pathology and Seed Investigations.—*Rep. N.Y. St. agric. Exp. Sta., 1944–5*, pp. 40–52, 59–63, 1945.

In this report [cf. *R.A.M.*, xxiii, p. 327; xxiv, p. 265] R. F. Suit states that blueberry [*Vaccinium* spp.] stunt [ibid., xxi, p. 496] was transmitted by grafting and also by aphids (? *Amphorophora vaccinii*) in one of 12 tests.

During 1944 vine black rot [*Guignardia bidwellii*] caused a total loss in some vineyards and required five treatments with Bordeaux mixture for its control elsewhere. For vine powdery mildew [*Uncinula necator*] alone two applications of Bordeaux mixture (2–4–100) plus 1 lb. rosin fish-oil soap sufficed. The pre-bloom spray was applied at the rate of 150 gals. per acre, and the later ones at 200 to 250 gals. The addition of a spreader-sticker improved disease control on the bunches. In limited trials three applications of fermate (2–100) gave better control of black rot than any other fungicide tested. In four seasons' observations of varietal resistance to black rot, downy mildew [*Plasmopara viticola*], and powdery mildew, Clinton only of 11 varieties was uninfected. Catawba and Niagara showed most infection, being attacked by all three diseases, as were Fredonia and Golden Muscat. Black rot was not observed on Delaware, Elvira, Ives, or Missouri Riesling, while Concord showed no downy mildew.

J. M. Hamilton and D. H. Palmiter report that, as usual, the sulphur pastes gave better protection against apple scab [*Venturia inaequalis*] than dry treatments. Fermate gave satisfactory control and puratized N5 X and isothan Q15 [cf. ibid., xxiv, pp. 138, 139] were promising.

In studies on peach leaf curl [*Taphrina deformans*: ibid., xxiii, p. 349; xxiv, p. 493], J. M. Hamilton found that elgetol (1 qt. per 100 gals.) and other DN [*dinitro*] compounds at an equivalent concentration gave better control than Bordeaux mixture and lime-sulphur, when applied after the buds had cracked. In another block fermate with zinc sulphate-lime and copper oxychloride sulphate with orthex [ibid., xxiii, pp. 33, 70, 444] gave good results.

J. M. Hamilton and G. L. Mack report the conversion of a commercial duster into a 'spray duster' for cherries and peaches by attaching a fish-tail device for applying the dust to the under side of the leaves, retention being assured by the atomization of a liquid into the dust stream. An aqueous 0·1 per cent. solution of polyvinyl alcohol doubled the dust deposit, with only about one-tenth the amount of liquid required for spraying.

In tests by W. T. Schroeder of fungicides as seed protectants spergon (2 oz. per bush.) gave the best results on canning peas and effectively eliminated friction in the drill. Arasan (2 oz. per bush.) came next, but caused friction in the drill. On sweet maize seed arasan (1·5 or 2 oz. per bush.) was as good as, or better than, any other material tested in the field. Treatments of Lima bean [*Phaseolus lunatus*] seed at different planting dates indicated that spergon and arasan at 2 oz. per bush. are the best materials to use where seed decay may occur. With spinach seed, arasan (1 per cent.), zinc oxide (2 per cent.), yellow cuprocide (0·5 per cent.), and red cuprocide (1·5 per cent.) gave the best results.

W. T. Schroeder, O. A. Reinking, and C. B. Sayre found that on soils infected by pea root-rot [*Aphanomyces euteiches*, *Fusarium solani* var. *martii* f. 2, *Pythium ultimum*, *Corticium solani*, and *Ascochyta pinodella*: ibid., xxii, p. 285], nitrogenous fertilizers to some extent controlled the severity of disease development.

In tests by W. T. Schroeder Tennessee tribasic, microgel, and COCS (44 per cent.), as well as Bordeaux mixture (4–2–50), gave better control of tomato blight (*Alternaria solani*) [ibid., xxiv, p. 294] than did dithane, fermate, or U.S.R. No. 604, but the two latter were equally more effective against anthracnose fruit rot [*Colletotrichum phomoides*: ibid., xxiv, pp. 168, 294]. Alternate applications of fermate and a copper fungicide, beginning with fermate, up to four or five sprays, gave almost as good control of early blight and as effective anthracnose control as the 'straight' copper or fermate schedules and if followed should give good yields and high quality fruit.

R. O. Magie states that, in further tests of the fungicidal treatment of hop twine and poles to control downy mildew [*Pseudoperonospora humuli*] on the young bines, the chemicals leaching out of the treated materials during rain protect the bines for four to six weeks during the period of rapid growth when spraying is impracticable. Twine treatment with a variety of fungicides plus a wetter (0·2 per cent. triton x-100 in water) showed copper compound A, yellow cuprocide, Tennessee tribasic, Bordeaux mixture, dithane, and thiosan giving good control without injury to the bine. Poles should be sprayed with some copper material of a concentration of 0·6 per cent. Other work showed that early-season applications of Bordeaux mixture (4–2–100) may damage young hop bines. Zinc sulphate-lime (6–3–100) applied in May and June controlled downy mildew without proving injurious. Frequent, thorough spraying with Bordeaux mixture did not prevent a late outbreak of powdery mildew [*Sphaerotheca humuli*]. It appears to be desirable to include a wettable sulphur (4 lb. per 100 gals.) in the July applications.

H. S. Cunningham and O. A. Reinking found that *Fusarium* seed-piece decay of potatoes (*F. caeruleum*, *F. sambucinum* f. 6, and *F. solani* var. *striatum*) [ibid., xxv, p. 139] occurs in seed stock not only in diseased tubers, but also on the surface of healthy ones. Of seed containing 10 per cent. infected tubers half was treated with yellow mercuric oxide (1–30) and dried, half was left untreated. All the tubers were then cut and bagged. Ten days later the treated tubers and the

untreated showed, respectively, 10 and 90 per cent. infection. When healthy, untreated tubers were cut, and part mixed with diseased seed pieces, the contaminated and uncontaminated seed pieces gave, respectively, 13 and 100 per cent. stand in shallow planting and 6 and 100 per cent. stand in deep. Shallow planting cannot be recommended as a control measure.

W. F. Crosier reports that New York State-grown hybrid maize was infected with *Diplodia zeae* in 5 per cent. of the stocks but not over 2 per cent. of the kernels in any stock. Stocks from other States were also infected. Sweet corn seed from other States for sale in New York State is commonly infected with *D. zeae*, occasionally with *Gibberella saubinetii* [*G. zeae*], and *F. moniliforme* [*G. fujikuroi*], and, rarely, with *Nigrospora sphaerica* [cf. ibid., xxiii, p. 383]. All these organisms remain viable for three to five years. Stowell's Evergreen seed stored for three years gave essentially the same percentage infection as originally. *A. radicina* [ibid., xxii, p. 340], isolated from diseased carrot and celery seed, was highly pathogenic. This is the first record of the fungus on commercial seed stocks at the Station. The control of stinking smut [bunt: *Tilletia caries* and *T. foetida*] in a badly infected stock of wheat given by new improved ceresan and copper carbonate was equalled only by 1452 C. In this experiment a planting rate of 2 bush. per acre was appreciably more profitable than one of 1 or 1·5 bush. The same dusts gave small but consistent increases in yield when used on disease-free wheat. Arasan controlled *D. zeae* and other fungi on maize seed; alone or diluted with flour it had no effect on germination, but it increased the green weight of the seedlings in a six-day test period.

Botany.—*Rep. Ga Exp. Sta., 1944–45*, pp. 48–58, [1945].

This report on plant disease work in Georgia [cf. *R.A.M.*, xxiv, p. 269] contains, *inter alia*, the following items of phytopathological interest. Spraying experiments gave no data upon which recommendations for spraying muscadine grapes [*Vitis rotundifolia*] against black rot (*Guignardia bidwellii*) [loc. cit. and preceding abstract] could be based. Surveys showed wide differences in susceptibility, Dulcet being the most resistant variety. The only form of leaf-spotting important on muscadine vines was angular leaf spot [*Mycosphaerella angulata*: ibid., xxi, p. 239]. The chief berry disease of muscadines was bitter rot (*Melanconium fuligineum*) [ibid., xxii, p. 126], which also caused speck on the vegetative parts.

Observations on snap bean [*Phaseolus vulgaris*] fields near Quitman in May, 1945, showed that root rot, which was causing about 20 per cent. reduction in stands, was due primarily to *Rhizoctonia* [*Corticium*] *solani*. A *Fusarium* sp. was isolated from many of the diseased plants. Inoculation experiments with *Macrophomina phaseoli* showed that infection from the soil causing charcoal rot occurs almost entirely through the cotyledons during emergence. Seed treatment may prove to be effective. The ashy stem-blight phase generally results from late leaf and stem infection of older plants by pycnospores, and does not affect the harvest of green beans, though it generally prohibits the growing of dry beans and seed. *Diaporthe sojae* [loc. cit.], which was commonly present on snap beans, cowpeas, soy-beans, and Lima beans [*P. lunatus*], is distinct from *D. phaseolorum* [cf. ibid., xv, p. 277; xxiii, p. 424]. Inoculation studies indicated that *D. sojae* is a saprophyte or, possibly, a weak parasite.

Treatment of machine-shelled Spanish groundnut seed with 2 per cent. ceresan, arasan, and spergon again gave significant increases in stand, ceresan giving the best results, followed in order by the other two. The results of two tests demonstrated that groundnuts may be safely hand- or machine-shelled four months before planting, if they are treated with an effective dust (e.g., 2 per cent. ceresan, spergon, dow No. 5 and No. 6 B at 3 oz. to 100 lb. seed or arasan at 2 oz.) at the time of shelling or any convenient date before planting.

In spraying and dusting tests against groundnut leaf spot [*Cercospora arachidicola* and *C. personata*] Spanish groundnuts were given three applications of fungicide. The average increases in yield per acre were, for eight tests with sulphur dust, 198 lb., for eight with copper-sulphur (10–90), 319 lb., and for two with Bordeaux (6–2–100), 241 lb. In a different test the maximum yield was obtained by digging 109 days after planting on undusted plots, and 116 days after planting on dusted plots, the yield of the latter showing an increase of 438 lb. per acre over the undusted.

Watermelon strain S 306, now designated Georgia No. 2, showed high resistance to wilt [*Fusarium bulbigenum* var. *tracheiphilum*: ibid., xxiii, p. 7], and has been sent to farmers for trial. Seed of the Georgia Wilt Resistant variety [loc. cit] is distributed annually. Several varieties of inedible cantaloupe resistant to downy and powdery mildews [*Pseudoperonospora cubensis* and *Erysiphe cichoracearum*: loc. cit.] were crossed with the Hearts of Gold, Hales Best, and Pride of Wisconsin and other varieties. About a dozen strains with high resistance to both mildews and with good eating qualities were isolated. It appears that resistance to downy mildew may be recessive.

Investigations showed that vetch anthracnose [? false anthracnose, *Protocoronospora nigricans*: ibid., xxii, p. 127] causes heavy losses to some species, smooth and hairy (*Vicia villosa*), purple (*V. atropurpurea*), and woolypod (*V. dasycarpa*) being the most susceptible. Damage is heaviest after prolonged wet periods in spring. Several strains of *V. sativa*, as well as *V. grandiflora*, are considerably more resistant.

On p. 14 it is stated that preliminary data confirmed previous results in indicating that some strains of the Empire cotton variety may be highly resistant to wilt [*F. vasinfectum*: ibid., xxi, p. 197]. For two years, CSS 3720 has shown up favourably in comparison with established varieties.

Annual Report of the Massachusetts Agricultural Experiment Station for the fiscal year ending 30th June, 1945 (Bulletin 428).—71 pp., 1 fig., 1 graph, 1945.

This report [cf. *R.A.M.*, xxiv, p. 404] contains, *inter alia*, the following items of interest. C. V. Kightlinger reports that new strains of Havana Seed tobacco for use in the Connecticut Valley are being produced, some of which give heavy yields of good-quality tobacco even in soils heavily infected with black root rot [*Thielaviopsis basicola*: ibid., xxiv, pp. 341, 403], and some are superior to Havana Seed 112 in type, quality, and growth habits.

W. G. Colby states that the new oat varieties Vicland, Tama, and Clinton have given good grain yields and shown high resistance to leaf rust [*Puccinia coronata*].

Investigations by W. L. Doran on the effects of various soil treatments on cabbage club root (*Plasmodiophora brassicae*) [ibid., xxiv, pp. 260, 483] demonstrated that infection was moderately well controlled without injury to the plants by mercurous chloride applied at the rate of 0·2 or 0·15 gm. per sq. ft. Sodium chloride applied alone did not give control, but at 10 gm. per sq. ft. appeared to favour plant growth. Mercurous chloride with sodium chloride gave better control than without it.

Further experiments on the relation between soil moisture content and damping-off again showed that by delaying the initial watering of seed pans for four to six days the stands of six common vegetables and three annual flowers were much improved.

Soil in which onions had shown poor growth and had been infected by pink root rot [*Phoma terrestris* and (?) *Fusarium vasinfectum* var. *zonatum* f. 1] was variously treated before planting onion sets or sowing onion seeds. The number of seedlings surviving, as compared with those in untreated soil, was increased 80 per cent. by sodium nitrate, and almost as much by fermate, though fermate did not prevent pink root rot. Severe pink root rot on onions from sets in untreated soil (a *Fusarium*

sp. being isolated from the affected roots) was partly controlled and early growth conspicuously improved by copper sulphate 200 lb. or sodium nitrate 400 lb. per acre.

E. F. GUBA found that certain primitive tomatoes received from the Division of Plant Exploration and Introduction were resistant to every local strain of *Cladosporium fulvum* [ibid., xviii, p. 769]. These types he has crossed with Bay State, a variety now highly susceptible to a variant strain of the fungus. Strains approaching desirability for greenhouse forcing appeared among the progeny of successive generations of crosses of Bay State with type No. 129882 from Peru and No. 112215 from Ecuador. Selected lines of these hybrids were crossed with Vetomold-121, Bay State, Waltham Forcing, and Marglobe. The best results were given by the crosses with No. 112215, and the F_3 generation will be grown in commercial greenhouse trials in the autumn.

When three plots of Blue Hubbard squash [*Cucurbita* sp.] were sprayed five times in an unusually dry season with Bordeaux mixture (4–4–50) plus 1 lb. calcium arsenate and spreader, the resulting yield, as in the previous year, was smaller than that from three corresponding unsprayed plots. Loss from decay in storage was negligible in fruit from all six plots, but shrinkage was greater among the sprayed than amongst the unsprayed squash.

L. H. JONES found that at a soil temperature of 70° F. mosaic-free Havana Seed tobacco leaves developed consistently in their normal ovate shape, whereas at 90° the newer leaves showed yellow spots and were light green, narrow, and very pointed, i.e., they showed frenching [ibid., xxv, p. 237]. Inoculation of healthy plants with juice from the frenched leaves gave no symptoms of mosaic, while controls inoculated with juice from mosaic-infected leaves developed mosaic symptoms. Plants grown at 70° having normal leaves soon produced frenched leaves at 90°, while others grown at 90° and showing frenched leaves produced some almost normal leaves at 70°.

Creosote injury to plants [unspecified] was found to be local. The fumes, arising from treated lumber exposed to the sun, pass into the leaves through the stomata and an exposed leaf may die. If, however, the injury occurs near the growing point, growth becomes arrested, and the plant dies unless it can develop lateral shoots, one of which becomes a leader.

H. E. WHITE states that the Field Station strains of snapdragons [*Antirrhinum majus*] continue to show strong resistance to rust [*Puccinia antirrhini*: ibid., xxiii, p. 20]. Thirty selections of resistant lines gave only seven with rust and these showed only 10 to 25 per cent. infection. Cuttings of eight carnation varieties treated with hormodin powder No. 1, stimroot powder (spergon plus hormone), or fermate powder or liquid showed no difference in degree of rooting. The tests showed that too much hormone powder may cause cuttings to be more susceptible to rot diseases.

Continuing their work on mushrooms (*Agaricus* [*Psalliota*] *campestris*) W. B. ESSELEN, A. FILIOS, W. H. FITZPATRICK, and E. WEIR showed that they contain approximately 203 mg. argenine, 458 mg. isoleucine, 242 mg. leucine, 144 mg. methionine, 5 mg. tryptophane, and 326 mg. valine per 100 gm. fresh weight. The total nitrogen was about 0·5 per cent., of which 63 per cent. was protein, purified mushroom protein having 11·79 per cent. nitrogen. It was concluded that fresh mushrooms contain approximately 2·67 per cent. protein. Commercially canned mushrooms (18 different samples) averaged 0·249 mg. riboflavin, 1·8 mg. nicotinic acid, and 0·83 mg. calcium pantothenate per 100 gm. total can content, the biotin content averaging 6·57 micrograms. In canning, blanching in hot water caused little or no loss of the B-vitamins, but there was significant loss in processing, while storage in cans for one year caused some loss of riboflavin but little or none of nicotinic acid, calcium pantothenate, and biotin.

ORTON (C. R.). **Biennial Report of the Director, West Virginia Agricultural Experiment Station, Morgantown, for the period 1942–1944.**—*Bull. W. Va agric. Exp. Sta.* 317, 56 pp., 19 figs., 1 map, 1944.

In the section of this report [cf. *R.A.M.*, xxiii, p. 27] dealing with plant diseases (pp. 34–40) it is stated that J. G. LEACH has devised a method of inoculating large numbers of bluegrass [*Poa pratensis*] plants with stripe smut [*Ustilago striiformis*: ibid., xxii, p. 485; xxiv, p. 318]; experiments are in progress in which promising resistant selections are being tested and susceptible plants eliminated.

L. H. LEONIAN and V. G. LILLY, using differential growth rates of bacteria and fungi, including yeasts, to detect and assess vitamins in foods, have demonstrated that certain [unspecified] fungi are so sensitive that a few parts per billion of B-complex vitamins suffice to permit their growth.

Several years' study of potato purple top have proved conclusively that it is caused by the aster yellows virus [ibid., xxiv, pp. 70, 406]. It is transmitted to potatoes by the aster leafhopper [*Macrosteles divisus*], and has a long incubation period in the potato, with the result that the disease does not appear until late in summer. Early potatoes escape with slight injury, while late varieties may show great reduction in yield and quality. J. G. LEACH found that infection must occur early in the season in order to produce injury. The disease is not perpetuated through the tubers, but tubers from infected plants give weak plants.

JONES (W.). **Check list of plant diseases in the coastal areas of British Columbia.**—B.C. Dep. Agric., 27 pp., 1945. [Mimeographed.]

This check list of plant diseases affecting over 200 host plants is based on data collated in connexion with periodic plant disease surveys of the coastal areas of British Columbia during the last ten years, the names of the diseases being listed in Latin and English under the Latin names of the hosts, together with the local distribution; an index of the common names of host plants is provided.

NEWTON (MARGARET) & JOHNSON (T.). **Physiologic races of Puccinia graminis tritici in Canada, 1919 to 1944.**—*Canad. J. Res.*, Sect. C, xxiv, 2, pp. 26–38, 1 fig., 1946.

During the period 1919 to 1944, 65 physiologic races were identified from 4,543 isolates derived from uredial collections of *Puccinia graminis* var. *tritici* [*R.A.M.*, xxv, p. 298]. In the Prairie provinces 49 races were recorded from 3,475 isolates; 40 in Eastern Canada from 1,013; and 12 in British Columbia from 55. Races 36, 17, and 21 were largely responsible for the severe losses suffered by Marquis and other common wheats during the period 1920 to 1930, and races 34 and 49 were frequently collected from 1927 to 1935, but all of them declined in pathogenicity between 1930 and 1936, whereas race 56, first recorded in Canada in 1931, has been the dominant rust pathogen since 1934, notably in the epiphytotic of 1935. Race 17 revived and challenged the pre-eminence of race 56 as a pathogen in 1941, but soon ceased to be serious [cf. ibid., xxiv, p. 222].

The distribution of races is similar, but not identical, as between eastern and central Canada; 36 and 21 are more common in the Prairie provinces than in the east, while the opposite is true of 38. Only about a dozen of these races can be considered as having serious economic importance and at least two-thirds of the others have only been found occasionally and have, for reasons which have not yet been ascertained, failed to secure even a limited distribution.

The presence of the common barberry in Eastern Canada is thought to offer some explanation of the rather greater variety of physiologic races of *P. graminis* found there, as compared with the Prairie provinces.

Johnson (T.). **The effect of DDT on the stem rust reaction of Khapli Wheat.**—*Canad. J. Res.*, Sect. C, xxiv, 2, pp. 23–25, 1 pl., 1946.

Seedling leaves of wheat varieties in the greenhouse at the Dominion Laboratory of Plant Pathology, Winnipeg, were sprayed with DDT (dichlorodiphenyl trichloroethane) (1 oz. to 5 gals. water) four days after being infected with race 17 of *Puccinia graminis tritici*. Ten days after spraying, uredosori somewhat larger than the minute type-1 pustule usually produced by race 17 on Khapli (*Triticum dicoccum*) appeared on that variety and in 24 days it appeared to be fully susceptible. Only Arnautka of the resistant wheats tested showed any similar tendency to susceptibility after DDT spraying which also appears to have induced a marked chlorosis on the leaves of some of these wheats, but not on those of others. On sprayed Khapli leaves there seemed a marked connexion between chlorosis and rust development. The possible effect of DDT insecticide on the reactions of hosts to fungi should not be overlooked.

Yu (T. F.), Wang (H. R.), Fang (C. T.), & Yin (S. Y.). **Studies on physiologic specialization in Tilletia tritici and T. levis in China.**—*Chin. J. sci. Agric.*, i, 4, pp. 281–287, 1944. [Received June, 1946.]

The information on wheat bunt (*Tilletia tritici* [*T. caries*] and *T. levis* [*T. foetida*]) presented in this paper has already been noticed from another source [*R.A.M.*, xxv, p. 208].

Foëx (É.). **Un champignon à sclérote du Blé. Son action parasitaire.** [A sclerotial fungus of Wheat. Its parasitic action.]—*Ann. Épiphyt.*, N.S., vii, 1, pp. 21–42, 21 figs., 1941. [Received April, 1946.]

In June, 1938, the author received from Ain [France] specimens of wheat plants injured by cold before earing and showing white lesions surrounded by brown zones on the lower internodes. These lesions contained a fungus with hyaline, septate, cylindrical or varicose, inter- and intracellular hyphae of varying diameter and small, black sclerotia.

A comparative study of the cultural characters of this fungus and of those of *Sclerotium rhizodes* [*R.A.M.*, xviii, p. 34] and *S. costantini* [ibid., xviii, p. 372] showed that the mycelium of the first was white, relatively thick, and formed flocculent masses in places, while the sclerotia were generally isolated and sparse; the mycelium of *S. costantini* was less thick and did not form flocculent masses; the sclerotia were more numerous, of medium size, isolated or in groups, and seldom formed large masses. In the Ain fungus the mycelium formed a thin layer, difficult to see, sclerotia were even more numerous, single, or, generally, in groups. At 22° C. *S. rhizodes* grew more slowly than the other two fungi. Increases in the colony diameters after 10 days at 24° to 25° for the Ain fungus, *S. costantini*, and *S. rhizodes* were, respectively, 124 to 130, 110 to 121, and 27 mm.

The sclerotia of *S. rhizodes* measured 800 to 1,550 μ wide and 550 to 1,000 μ high, as against 550 to 900 by 300 to 650 μ, for *S. costantini*, and 250 to 650 by 100 to 350 μ for the Ain fungus. The three types of sclerotial fungi differed also in their anatomical structure.

Experimental inoculations of Bon Fermier wheat and Probstdorf barley seedlings in pots under glasshouse conditions were made by inserting a pure culture of the Ain fungus in the soil. It showed great virulence, many inoculated plants being killed, and numerous sclerotia being produced.

The author considers that although there are differences between the Ain fungus, *S. costantini*, and *S. rhizodes*, they cannot be considered as distinct species. All three present certain analogies with the organisms which Samuel and Garrett in Australia and Sprague in Oregon have referred to *Rhizoctonia* [ibid., xii, p. 159; xvi, p. 801; xix, p. 74], while the lesions described by Sprague resemble those

caused by the Ain fungus and *S. costantini*. In a letter to the author (quoted in a footnote) Whetzel suggested that the author's culture of *S. costantini* sent to him might be closely related to *S. rhizodes*, which, while a true species, is closely related to *R.* [*Corticium*] *solani*, and of which it may be a variety. A comparison of the author's *S. costantini* and *S. rhizodes* showed, however, that these two were not identical. Whetzel suggested that the Ain fungus should be either referred to *C. solani*, or regarded as a slight variant of *S. costantini*, if it was desired to retain this species. He thought it likely that a variety of strains of *S. costantini* (or as he prefers, *C. solani*) might be isolated from different localities in France. The author inclines to agree with Whetzel, but prefers not to come to a definite conclusion as he lacks material for comparison.

Foëx (É.). **Revue des travaux sur diverses maladies des céréales déterminées par des champignons à sclérotes.** [A review of the work on different cereal diseases caused by sclerotial fungi.]—*Ann. Épiphyt.*, N.S., vii, 1, pp. 43–53, 1941. [Received April, 1946.]

The author succinctly reviews and discusses investigations carried out by numerous workers on the cereal diseases due to *Typhula itoana* [*R.A.M.*, xix, p. 434], *Sclerotinia graminearum* [ibid., xviii, p. 581], *Sclerotium rhizodes* [see preceding abstract], and *S. rolfsii*, a separate bibliography being appended to the account of each disease.

Hagborg (W. A. F.). **The diagnosis of bacterial black chaff of Wheat.**—*Sci. Agric.*, xxvi, 3, pp. 140–146, 4 figs., 1946.

With a view to avoiding the confusion which has occurred among diseases resembling black chaff of wheat (*Xanthomonas translucens* f. sp. [var.] *undulosa*) [*R.A.M.*, xvi, p. 91], for example, *Septoria* glume blotch (*S. nodorum*) [ibid., ii, p. 211], brown necrosis (*Helminthosporium sativum*), *Alternaria* blotch [*A. tenuis*: ibid., xxii, p. 15], pseudo-black chaff [ibid., xii, p. 561], basal glume rot (*Pseudomonas atrofaciens*) [ibid., xvi, p. 91], and internodal melanism, methods are outlined for its diagnosis. They embrace macroscopic and microscopic examination of the diseased tissues and bacterial smears, the isolation of the causal organism, and its determination on the basis of its pathogenic and serological reactions and its morphological and physiological properties. For the pathogenicity tests Thatcher wheat, Victory oats, Star barley, and Prolific (Spring) rye are recommended, and for the serological tests the author used a phenolated physiological salt solution.

Bowman (D. H.). **Sporidial fusion in Ustilago maydis.**—*J. agric. Res.*, lxxii, 7, pp. 233–243, 2 figs., 1946.

In this study, undertaken to determine the conditions conducive to sporidial fusion of *Ustilago maydis* in culture and the subsequent nuclear behaviour, the fusion of compatible sporidia or hyphae was found to depend on nutrition and temperature [*R.A.M.*, xi, p. 569], which conditioned the time required for fusion to occur. Fusions began after 15 hours in distilled water or 1 per cent. malt extract at 20° to 24° C. and were readily observed after 20 to 48 hours. Lower temperatures delayed fusion and none occurred below 12°, while at higher temperatures rapid vegetative budding obscured the fusions.

Observations of the nuclear behaviour of *U. maydis* showed that at the time of fusion, or immediately after, the nucleus in each of the fusing gametes divided, and a daughter nucleus from each entered the fusion tube or cell, which was then cut off by walls. The binucleate hypha, each cell of which contained one pair of nuclei, then grew out. The present studies did not support the view frequently suggested

that the protoplasmic contents of the fused sporidia pass into the fusion hyphae and progress toward the tip as growth develops, leaving empty cells behind.

WHITE (N. H.). **The etiology of take-all disease of Wheat. 1. A survey of a take-all affected field at Canberra, A.C.T. 2. Progressive necrosis and microfloral succession in root and crown tissue of Wheat.**—*J. Coun. sci. industr. Res. Aust.*, xviii, 4, pp. 318–328; 329–335, 3 figs., 1 graph, 1 pl., 1945.

In the first of these papers the author records some preliminary observations made during a detailed survey from 1939 to 1942 of a wheat field at Canberra affected with take-all, beginning with the first year's cropping after conversion from a savannah-woodland natural pasture. Although affected plants occurred singly or in small groups throughout the field, they were more noticeable in large, irregular, well-defined areas. Soil samples from these and adjacent healthy parts of the field showed no significant differences in physical condition, organic carbon and nitrogen content, or P_H reaction. Of plants taken at random from both areas, 64 per cent. from the former and 7 per cent. from the latter developed perithecia of *Ophiobolus graminis* [*R.A.M.*, xxv, p. 210] on the culm bases, though platings from both lots gave other fungi, the species of which and their frequency in the two lots were identical. The organisms obtained included *Fusarium culmorum* and *Helminthosporium sativum*.

While in the first two seasons the affected patches were in well-defined areas, in the next two the diseased plants were more widely and uniformly distributed. The position of the affected areas shifted from season to season, though they tended to overlap in succeeding years.

Seedling-blight symptoms were invariably associated with the presence of *O. graminis*. The distribution of plants with such symptoms was significant, the clustering suggesting the presence of a locality factor, probably foci of inoculum. The evidence indicated that local soil differences other than those studied, and the location of foci of inoculum of *O. graminis*, may determine the position of take-all patches in the field.

In the second paper records of the health ratings and samplings of selected areas at eight stages of development from seedling to stubble in the 1941 season are given. These showed that the seminal roots, crown roots, and crown tissues became progressively diseased in number and extent (and in that order) as the crop developed. At the ripe stage all plants had root lesions but only 17 per cent. were white-eared; these had most severe root necrosis. Lesions in these tissues gave cultures of *O. graminis* at first, but later samples yielded less of *O. graminis* and more of other fungi. At the stubble stage *F.* spp. were always dominant. Parallel platings of healthy tissues at first showed no organisms present, but when the tissues became mature and senescent, they were populated with fungi and bacteria resembling those found in diseased tissue but never with *O. graminis*.

The results of this study fully confirm Garrett's view [ibid., xvi, p. 306] that the relation between *O. graminis* and other soil inhabitants should be regarded from an ecological standpoint, and that there seems to be a regular succession in diseased wheat roots, the initial cause being the presence of *O. graminis*, the lesions produced by which provide a non-living substratum suitable for the growth of saprophytes. These appear unfavourable to the growth of *O. graminis*, runner hyphae from which invade further healthy tissue, producing new lesions, and again the replacement is repeated. The character of the succession in each lesion depends on the climatic conditions of the rhizosphere, mainly aeration, temperature, moisture, and P_H reaction. Fungi isolated from the basal parts of mature wheat plants with take-all symptoms may not necessarily be causally related to the disease, but may represent a climax of fungal development terminating the microfloral succession following the entrance of the primary parasite.

Pathology and mycology of Corn.—*Rep. Ia agric. Exp. Sta., 1941–42*, Part II, pp. 31–59, 2 figs., 1 diag., [? 1942. Received March, 1946].

Among many items of phytopathological interest in this report (cf. *R.A.M.*, xxiv, p. 365] the following may be mentioned: R. H. PORTER and W. N. RICE found that in soil naturally infected with *Pythium* spp. and maintained at high moisture content the germination of maize was lowered by low temperature (10° to 12° C.). The use of spergon and 1 per cent. ethyl mercury phosphate [new improved ceresan] assured satisfactory protection against *Pythium* spp.

Field stands of sorghum were improved by seed treatment with spergon, copper carbonate, or 0·5 per cent. ethyl mercury phosphate.

Poor stands from seed maize which had tested well for germination were found on investigation by L. A. TATUM and G. F. SPRAGUE to be due largely to injury to the pericarp over the germ. The damage was attributed to rough processing and handling and was greater when the moisture content was below 14 per cent.

In virulence tests with 72 cultures of 41 transfers of three single-cell strains of *Phytomonas* [*Xanthomonas*] *stewarti* carried on for 15 months, E. W. LINDSTROM showed that a bacterial variation became evident in the fourth transfer and ultimately all three strains developed a striking colony variation. In the agar medium two levels of P_H were employed at 7·0 and 8·0 to 8·4 and three of glycine at 0, 0·04, and 0·8 per cent. The colony morphology varied significantly in subcultures of each of the three lines and there were even variations in colony colour. Cultures of these six treatments (and of the originals as controls), with duplicates of each of the three strains, were tested after the 23rd and 41st transfers on a highly susceptible inbred variety grown in randomized blocks with three replications of eight plants. Each plant was inoculated hypodermically, and the results are presented in a lesion table. Differences, often considerable in the case of the virulent strains, were usually towards a marked attenuation. With both virulent strains virulence tended to increase with the higher P_H but not with the avirulent strain. The general conclusion is that bacterial virulence is more likely to be selected by the fixation of bacterial mutants in a test tube rather than by environmental influences of P_H or glycine.

C. S. REDDY demonstrated in laboratory and greenhouse tests the superiority of spergon, used at 1½ oz. per bush., over other seed treatments for the protection of maize both before and in the course of germination.

In experiments reported by I. E. MELHUS and G. C. KENT triethanolamine oleate, butylamine oleate, potassium oleate, dupanol 80, and W. S. Dupont exerted the least fungicidal activity and a nearly maximum surface tension depression at 0·4 per cent. concentration in laboratory tests to assess the value of various surface tension depressants in facilitating the penetration of inoculum of *Ustilago zeae* [*U. maydis*] into susceptible tissue within the leaf whorl. To obtain infection of seedlings in the shortest possible time the tip of the coleoptile was cut off and the leaves exposed or the young leaves were allowed to pierce the coleoptile or to reach the two- to three-leaf stage before inoculating; no depressant was necessary. Infection of young maize plants can thus be achieved at an age of 5 to 7 days, the symptoms occurring 7 to 14 days after inoculation, or 12 to 21 days after planting.

Spore collections made in 1941 of the fungus formerly described as *Basisporium gallarum* are all referred by C. S. REDDY to *Nigrospora oryzae* [cf. ibid., xvii, p. 670; xxi, p. 368]. The wide variability precludes their segregation into two species.

In studies by G. SEMENIUK *et al.* highly significant differences in the rotting of the pith of 49 crosses of dent maize, previously greenhouse-tested for seedling reaction to *Diplodia zeae*, were noted following field inoculation of the stalks of these plants with *D. zeae* in August, 1941. There were also wide differences in the percentage of dead stalks in the uninoculated plants at the three dates on which

statistics were taken. A very dry July and August, followed by a very wet September and October, rendered the disease more epiphytotic than in 1940. The data collected showed no particular correlation between greenhouse seedling reaction and field results for spread of *D. zeae* in the pith and the percentage of dead stalks. There was a highly significant correlation between the development of the fungus in the pith and the percentage of dead stalks in uninoculated plants.

In the two surveys of stored maize [ibid., xxiv, p. 364] G. Semeniuk found species of *Aspergillus*, *Penicillium*, *Fusarium*, *Oospora*, *Gibberella*, *Basisporium*, and *Helminthosporium* present in the first lot of 60 bins, while *Penicillium*, *Mucor*, *Aspergillus* spp., and bacteria predominated in the second series of samples. Growth of several of the fungi occurred at from 5° to 40° C. on potato dextrose agar, indicating that deterioration can occur at very low and high temperatures. Germination tests of samples of stored maize from the upper half of bins attacked by moulds showed complete loss of viability in 7 bins, less than 50 per cent. germination in 20, and under 75 per cent. in 38, the loss of viability being usually in inverse proportion to the depth of maize in the bin.

McLaughlin (J. H.). **Corn seed treatment in Oklahoma.**—*Bull. Okla. agric. Exp. Sta.* B-294, 14 pp., 1 fig., 1946.

Chemical dust seed treatment tests were undertaken from 1943 to 1945 by several agricultural experimental stations of the southern United States under the auspices of the Oklahoma Station.

In 1943 the dusts tested were arasan, Du Bay 1451-D, spergon, semesan jr., and barbak-D, arasan and Du Bay having not been tested previously on maize seed [cf. above, p. 332]. Seedlings, which were not very vigorous, planted on 19th April in soil below optimum temperature, suffered loss from soil pathogens following heavy rain and lowered soil temperatures from 1st to 5th May. The seedling count on 28th May showed beneficial results from all the seed treatments, Woods Golden Dent showing 31 per cent. increase. In a second test of treated seed planted on 4th June under optimal conditions for germination Golden Queen and Woods Golden Dent proved unresponsive to treatment, but 10 per cent. increases were recorded for Hays Golden, Mosby, and Jarvis Golden Prolific varieties.

Tests with the same dusts, apart from arasan, with early (31st March), medium (6th April), and late (18th April) plantings in 1944 on five different seed lots, using five replications, showed semesan increasing seedling stands of Woods Corn by 56 and 29 per cent. in the two later plantings, although wider success attended spergon, notably with Woods Corn, Louisiana Hybrid 468, and Hastings Prolific, and Du Bay was a good second to these. The planting for 6th April was followed by increased yields from treated grain of at least 10 per cent. in half the possible instances. Tests in 1943 and 1944 with eight different dusts at rates of application varying from $\frac{3}{8}$ to $2\frac{1}{2}$ oz. per bush. of seed showed no material differences between the various rates for any one chemical.

In tests with Hays Golden and Golden Queen seedling emergence and yields were increased by 10 per cent. or more by using arasan, USR 604, and yellow cuprocide at 1 oz. per bush. seed; semesan jr., barbak C, and Du Bay 1451-D at $1\frac{1}{2}$ oz. per bush.; and dow 9 A and 9 B at 2 oz. per bush.

In 1943, 78, 78, 71, 68, 64, and 91 isolations of fungi from the mesocotyls of seedlings were made per 100 plants treated respectively with arasan, spergon, semesan jr., barbak D, Du Bay 1451-D, and from non-treated seed. Most of these fungi were *Fusarium moniliforme* [*Gibberella fujikuroi*], giving 30 to 83 isolations per 100 plants.

Isolations of *Diplodia zeae* [*R.A.M.*, xxii, p. 475] were two for arasan, five for semesan jr., and one for Du Bay 1451-D, there being no *D. zeae* isolations per 100 plants treated with spergon, barbak D, or left untreated. Other isolations

included *Cephalosporium acremonium* and saprophytic species of *Rhinotrichum*, *Penicillium*, and *Fusarium*. Spergon (non-volatile) did not appear as effective as volatile chemicals.

LEWIS (H. C.). **Spray injury from zinc-lime sulphur in central California.**—*Calif. Citrogr.*, xxxi, 4, p. 112, 1 fig., 1946.

The addition of zinc oxide to lime-sulphur for the control of mottle leaf in citrus orchards [*R.A.M.*, xvii, p. 743] has caused light injury to oranges. This zinc-lime-sulphur burn or 'scratching' is different from the typical lime-sulphur burn in that it is much less severe, is confined to small scars or irregular scratches or, if severe, to elongated sunken scars on the fruit, and is common in cool weather. In one experiment spraying with 2 per cent. lime-sulphur alone caused injury sufficient to reduce the grade of 6 per cent. of the fruit. The addition of 1 lb. and 2 lb. zinc oxide per 100 gals. increased this percentage to 13 and 35, respectively. Substitution of the oxide by zinc sulphate at the rate of $2\frac{1}{2}$ to $3\frac{1}{2}$ lb. gave no improvement, but when as much as 7 lb. was added the fruit damage was lowered to 0·5 per cent., due to the neutralization of the lime-sulphur by the zinc sulphate. This spray applied in early spring at petal-fall should give good control of insects and mottle leaf, and eliminate scratching and lime-sulphur burn.

DE URRIÉS Y AZARA (M. J.). **Acerca de una coniothyriosis de la Naranja.** [Concerning a coniothyriosis of the Orange.]—*An. Jard. bot. Madr.*, v, pp. 140–142, 1 pl., 1 fig., 1945.

The epicarp of one of three oranges from the province of Badajoz, Spain, submitted to the writer for inspection, presented a large, pale, ochre-coloured area with a greenish halo, while the two others bore sunken lesions blackened by the superimposition over the original infection of an extraneous sooty mould mycelium. A species of *Coniothyrium* was isolated from the affected tissues, but inoculation experiments on ripe oranges gave negative results. It is named *C. pax-augustanum* n. sp. and is characterized by globose, depressed pycnidia, 130 to 220 μ in diameter, a black parenchymatous context, and broadly ellipsoid or sub-globose, dark brown conidia, 8 to 10·5 by 6 to 8 μ, the shape and dimensions of which distinguish them from the similarly coloured ones of *C. fuscoatrum*.

CHEO (C. C.). **Verticillium wilt of Cotton in Yunnan.**—*Chin. J. sci. Agric.*, i, 4, pp. 258–263, 2 figs., 1944. [Chinese, with English summary. Received June, 1946.]

A pseudosclerotia-forming fungus tentatively identified as *Verticillium dahliae* was detected on cotton (*Gossypium barbadense*) for the first time in China at Mengtse, Yunnan, in 1939. The pathogenicity of the fungus was demonstrated by inoculation and re-isolation experiments. Of nine plants used in host-range tests, only eggplant contracted infection from the cotton strain of the organism. Seeds from diseased plants were proved not to constitute a source of contamination. A strain of Egyptian cotton immune from the wilt was discovered by means of greenhouse resistance trials.

DRECHSLER (C.). **A clamp-bearing fungus parasitic and predaceous on nematodes.**—*Mycologia*, xxxviii, 1, pp. 1–23, 7 figs., 1946.

Continuing his researches on Hyphomycetes parasitic on nematodes [*R.A.M.*, xxi, p. 15], the author describes a new species of fungus occurring on decaying leaves of cucumber and other plants in Colorado, and named by him *Nematoctonus haptocladus*. The organism captures and devours various nematodes, notably *Panogrolaimus* sp., which it destroys in a free condition.

DRECHSLER (C.). **Three new Zoöpagaceae subsisting on soil amoebae.**—*Mycologia*, xxxviii, 2, pp. 120–143, 6 figs., 1946.

The morphology and behaviour of three additional members of the family Zoöpagaceae [*R.A.M.*, xx, p. 462; xxi, p. 488] are critically described, namely, *Cochlonema agamum*, n. sp., *Acaulopage lophospora*, n. sp., and *A. hystricospora*, n. sp. *C. agamum* is an endoparasitic fungus on soil amoebae and occurs on decaying leaves of cucumber and *Syringa* sp. in Colorado. *A. lophospora* and *A. hystricospora* also capture and consume amoebae and are found, respectively, on *Syringa* sp., *Populus* sp., and *Tamarix* sp. in Colorado and on pansy in Maryland.

MILLIKAN (C. R.). **Zinc deficiency in Flax.**—*J. Dep. Agric. Vict.*, xliv, 2, pp. 69–73, 88, 5 figs., 1946.

Flax in Victoria, particularly in the Portarlington district, in each of the seasons 1942 to 1945 showed symptoms of zinc deficiency [*R.A.M.*, xxiii, pp. 249, 436]. Bronze-coloured spots appeared on the upper leaves four to six weeks after germination, generally associated with or preceded by a rusty-brown discoloration of the top of the stem. Die-back, with or without foliar discoloration, occurred. Resumed growth often developed so well that the crop reached standard length and was duly harvested.

An extensive field experiment, with Liral Crown flax, to investigate the effect of time of sowing and zinc and phosphate manurial treatments showed that incidence was highest in the June sowing, whereas progressive and significant reductions in the percentages of both 'die-back' and 'total zinc deficiency' occurred in the July and August sowings. The symptoms were least marked in the August sowing.

Dressings of zinc sulphate at 30 lb. per acre exerted a considerable degree of control. Superphosphate dressings by themselves had no effect, but when applied at the rate of 10 cwt. per acre in conjunction with 30 lb. zinc sulphate per acre, there was a significant increase in the incidence of the symptoms over that occurring with zinc sulphate alone.

NEERGAARD (P.). **Nye eller upaaagtede Prydplantesygdomme i Danmark. 13–18.** [New or unheeded ornamental plant diseases in Denmark. 13–18.]—*Gartnertidende, 1943*, 8, pp. 95–98, 3 figs., 1943. [Received June, 1946.]

Further information is presented on some diseases of ornamental plants in Denmark either new to the country or previously overlooked [cf. *R.A.M.*, xx, p. 579 and next abstract]. *Gloeosporium physalospora* Cav. occurs in a destructive form on indoor plants of *Cissus antartica*, causing a wilt of the main shoot extending down the stem. The infection had presumably originated in the nursery and continued to develop under room conditions.

Peronospora arthuri, a new record for Denmark, was first observed on *Clarkia elegans* [ibid., xvii, p. 114] in July, 1940, and recurred with great severity under particularly adverse conditions for the host in 1942, when the financial damage sustained by nurserymen in various localities of Zealand was estimated at Kr. 5,000. Several varieties of *C. elegans* were affected, including Alba, Brilliant, Glorious, Ruby, and Salmon and Scarlet Queens, whereas adjacent plantings of *C. pulchella* and its var. *rubra* and the related *Godetia hybrida* were free from attack. The fungus spreads from the lower to the upper leaves, forming on the under sides flocculent patches of mould, white at first, later grey with a faint purple cast, and ultimately brownish-grey, and on the upper ones diffuse, pale yellowish areas. In the final stages of the disease the leaves are shed. The oospores of the fungus may persist in the soil for several years, necessitating the lapse of a protracted period between one planting of *C. elegans* and the next. Another wise precaution

(the disease being probably, though not certainly, seed-borne) consists in seed disinfection by half an hour's immersion in 0·5 per cent. uspulun. Unduly close spacing should be avoided in order to permit the free circulation of air between the plants. Spraying or dusting should be started in good time before flowering and continued throughout the growing period.

Clivia miniata is subject to a disorder of obscure etiology known as 'marginal spot', the initial symptom of which is the formation along the leaf margins of scattered, clear, yellowish spots, 1 mm. in diameter. Later more or less extensive, often very irregular, sharply delimited areas of the leaf develop intensive bleaching, turning from yellow to brown and eventually shrivelling, with the original small spots now dark brown and well defined. Another disturbance liable to confusion with the foregoing, known as 'cork disease', is characterized by the development on the foliage of numerous small, brownish, irregular, suberized, slightly raised areas.

The vegetable marrow leaf spot caused by *Septoria cucurbitacearum* was observed for the first time in Denmark causing severe infection in a Copenhagen market-garden in September, 1942.

A foliar spotting of ivy (*Hedera helix* var. *hibernica* f. *variegata*) due to *Amerosporium trichellum* (Fr.) Lind has been prevalent in the country since the eighties of last century, but in August, 1941, the pathogen was detected in a new form causing stem desiccation. Control measures are briefly indicated.

Pansies (*Viola tricolor* var. *hiemalis*) in a south Jutland market-garden sustained heavy damage in November, 1942, from a leaf spot produced by *Centrospora macrospora* (Osterw.) n. comb. (syn. *Cercospora macrospora* [and see *Ansatospora*: ibid., xxiv, p. 305]; *Centrospora ohlsenii* Neerg. in *Zbl. Bakt.*, Abt. 2, civ, pp. 407–412, 1942), which had already been present on the same site for the past three or four years. The immature seeds in several capsules of the plants submitted for examination were contaminated by the fungus, so that seed disinfection should be one of the control measures adopted, while soil sterilization to destroy the perennating mycelium is also recommended.

NEERGAARD (P.). **Stueplanternes Sundhedspleje. En Statistik over Forespørgsler om Sygdomme og Skadedyr paa Stueplanter.** [Hygiene of indoor plants. Statistics of queries concerning the diseases and pests of indoor plants.]—*Gartnertidende, 1943*, 17, pp. 205–206, 3 figs., 1943. [Received June, 1946.]

During the period from 1939 to 1943 the writer dealt with a number of queries concerning the health of indoor plants in Denmark [see preceding abstract], and further information on this subject was supplied by N. F. Buchwald, who was engaged on similar problems. Of 347 requests for advice, 209 related to physiogenic disorders of various kinds and only 24 to fungal or bacterial infections, the former of which included *Gloeosporium affine* on *Hoya carnosa*, *Exobasidium japonicum* on azalea [*Rhododendron*], *Oidium begoniae* on *Begonia* [see next abstract], *Phyllosticta aspidistrae* on *Aspidistra*, and *Sphaerotheca fuliginea* on *Veronica myrtifolia*.

ZOBRIST (L.). **Begonien-Mehltau.** [Begonia mildew.]—*Gärtnermeister*, xlix, 3, pp. 17–19, 6 figs., 1946.

Begonia mildew, caused by *Erysiphe polyphaga* (*Oidium begoniae*) [*R.A.M.*, xxv, p. 236], is responsible for more or less severe damage to a number of varieties in the Zürich district of Switzerland, among the most susceptible being two types of Gloire de Lorraine, namely, Eges Favorit and Schnee, *B. elatior* (various), *B. bertinii*, *B. hybrida-multiflora* (Salmon Glory), and *B. tuberosa-hybrida* (various). Satisfactory control may be effected by three monthly prophylactic treatments with 0·1 per cent. cupromaag plus 0·3 per cent. deril (an insecticide and wetter).

MASSEY (L. M.). **Brown-canker control.**—*Amer. Rose Annu., 1945*, pp. 147–150, 1 fig., 1945.

Brown canker (*Cryptosporella* [*Diaporthe*] *umbrina*), the agent of considerable damage to roses in the United States [*R.A.M.*, xviii, p. 41; xxii, p. 24], may be effectively combated by the following control schedule (also applicable to stem canker, caused by *Coniothyrium fuckelii*): attention to drainage, exposure, manuring, and other cultural practices for the maintenance of normal vigour; prompt removal and destruction of all dead and sickly material; systematic spraying for disease and insect extermination; care in the avoidance of injury to stems; and thorough scrutiny of large, old plants, e.g., of *Rosa setigera*, which are commonly placed at the back of the shrubbery and thus tend to escape observation. Drastic pruning is probably preferable to light for brown-canker control. Under suitable moisture and temperature conditions the fungus can enter the plants through uninjured tissues, hence the value of protective fungicidal treatments, as applied against black spot [*Diplocarpon rosae*].

GUBA (E. F.). **Carnation wilt diseases and their control.**—*Bull. Mass. agric. Exp. Sta.* 427, 64 pp., 14 figs., 1945.

This comprehensive monograph classifies the principal fungal diseases of carnations [*R.A.M.*, xxii, p. 387; xxiii, p. 389] recorded in Massachusetts, namely, spot, blight, and canker caused by *Alternaria dianthi*; root and crown rot caused by *Fusarium avenaceum*, *F. culmorum*, and other *Fusarium* spp.; branch rot or wilt caused by *F. dianthi*; and stem rot caused by *Rhizoctonia* [*Corticium*] *solani*; describes their symptomatology and history, the temperature relations which favour their pathogenicity and mode of infection; discusses the selection, preparation, and disinfection of cuttings; and investigates the age of plants in relation to disease and yield, cultural methods, disease resistance, soil sterilization, and measures for disease control.

Distinctive as are the symptoms of these pathogens, wilting is the common result of their incidence. Injuries to roots, stems, and branches and notably the incised surface at the base of cuttings, invite attack by *A. dianthi*, *F. culmorum*, *F. dianthi*, and *R.* spp., and the first and last-named may infect uninjured plants in humid atmospheric conditions. Except in the case of *C. solani*, disease incidence in cuttings and young stock results largely from infection latent therein or from superficial spore inoculum, and is derived from unhealthy stock plants or from normal plants near unhealthy specimens.

New, clean sand should be used after each crop of rooted cuttings; plants should be cut smoothly and cleanly, leaving no loose ends of tissue; and the most effective general control of disease is immersion for 15 minutes in a 1 in 1,000 solution of potassium permanganate ($\frac{1}{4}$ oz. to 2 gals. water). Dusting the base of cuttings with a 10 per cent. fermate or arasan application controlled wilt caused by *F. dianthi* without harming the root action.

Cultivation in the greenhouse throughout the year is considered to decrease the dangers from *Alternaria* blight inherent in field planting; and transplanting from greenhouse to field should take place not later than the first week in July, care being essential in so doing to avoid injury. Old stock is most susceptible to injury and infection and less tolerant of changes and adverse conditions of growth. High temperature and humidity, often met with from July to September, encourage wilt disease, and the stem-rot fungus *C. solani* is dangerous where plants are set deeper than the roots.

Careful tending of young and flowering plants, discarding of all progressively infected stock, segregation according to the age of plants, and cultivation of resistant varieties are assets in disease control.

Lists of varieties resistant to *A. dianthi* and *F. dianthi* are given. Sterilization of potting and flatting soil by suitable methods is desirable.

Conidia of *A. dianthi* were killed by powdered naphthalene, copper compounds, and calcium arsenate; lead arsenate, lime, and sulphur fungicides were non-toxic. Bordeaux mixture with calcium arsenate and fish oil and dusting mixtures containing naphthalene, calcium arsenate, monohydrated copper sulphate, and lime controlled *Alternaria* blight in small-scale tests; and Bordeaux mixture 4–4–50 with 1 lb. calcium arsenate and $\frac{1}{2}$ pint penetrol gave notable control of field epidemics. Calcium arsenate used alone was harmful and dusting materials unsatisfactory. Frequent treatments with a power-sprayer after fielding of plants in May and continued until benching time in the greenhouse, or until early July, are recommended, particularly for susceptible field-cultivated varieties.

WILHELM (S.), GUNESCH (W.), & BAKER (K. F.). **Myrothecium crown and stem canker of greenhouse Snapdragons in Colorado.**—*Plant Dis. Reptr*, xxix, 27, pp. 700–701, 1945. [Mimeographed.]

Wilting of leaves and flowering stems caused by *Myrothecium roridum* affecting from 2 to 3 per cent. of mature snapdragon [*Antirrhinum majus*: *R.A.M.*, xv, p. 157; xxiii, p. 191] plants in a commercial greenhouse at Denver during the autumn and winter of 1944 was accompanied by the characteristic symptoms of saturated lesions on the crowns, developing into depressed, dry, and cracked cankers, strewn with filamentous, white mycelium and black sporodochia, about 1 mm. in diameter, edged with white mycelium, and coalescing to form larger areas. In damp conditions or in a moist chamber, and on culture media these sporodochia appear in abundance, and *M. roridum* thrives in high humidity.

M. roridum has been reported commonly on *Viola* and pansy stems in England and on snapdragon stems [ibid., xvii, p. 590] in Texas and England. Since its description in 1790 it has been recorded on various hosts from Austria, Belgium, Ceylon, Germany, Hungary, Italy, Mexico, Sweden, and Switzerland. Its capacity to infect vigorous plants and notably unwounded *Viola* and pansies has been established, and its infection of snapdragons is seemingly similar.

Control is obtained by sanitation and suitable cultural methods, avoiding too much use of water and overhead spraying; using sterilized soil in field and greenhouse; and removing and burning infected plants.

SPRAGUE (R.). **Additions to the Fungi Imperfecti on grasses in the United States.**—*Mycologia*, xxxviii, 1, pp. 52–64, 2 figs., 1946.

The author gives descriptions of 13 Fungi Imperfecti on grasses in the United States, including seven species on *Septoria* (one new, namely *S. digitarivora*), three of *Stagonospora*, one being recorded as *S. agrostidis* forma *angusta* f. nov., *Ansatospora bromi* (Sprague) n. comb. proposed for *Cercospora bromi* on *Bromus rigidus*, and *Ovularia hordei* (Cav.) n. comb. for *Ophiocladium hordei* on *Phalaris arundinacea*. The last-named is said to cause an obscure disease of barley in northern Europe but has not been reported on barley in the United States.

SPRAGUE (R.). **Septoria disease of Gramineae in the western United States.**—151 pp., 19 figs., 2 pl., Oregon State College, Corvallis, Oregon, 1944. \$1·50. [Received March, 1946.]

In this important monograph on the *Septoria* disease of Gramineae [cf. *R.A.M.*, xxv, p. 155 and preceding abstract], which attacks 94 species of grains and grasses in the western United States, the species are described, where the information is available, under the following headings: geographical distribution and economic importance, symptomatology, pure culture and artificial inoculations, morphology, and taxonomy, with tabulated data and critical commentary in respect of 21 species

and some varieties. The following are new: *S. quinqueseptata* n. sp., forming spots sometimes associated with *Darluca filum* and *Cercospora agrostidis* and collected on *Sphenopholis obtusata* in North Dakota in 1915; *S. jaculella* n. sp. on *Bromus* spp., very common west of the Rocky Mountains on the polymorphic host species, *B. carinatus*, and also recovered from *B. ciliatus* in Arizona, *B. laevipes* in California, *B. rigidus* in Oregon and Washington, and *B. tectorum* in Washington; *S. tritici* Rob. f. *avenae* n. comb., destructive to common oats and more severely to red oats (*Avena byzantina*). The wild oat (*A. fatua*) is highly susceptible and acts as a carrier in late winter; the disease has since been observed in eight counties in Oregon and has been found on common winter, red, and wild oats in Washington; *S. tritici* Rob. f. *holci* n. f. on *Holcus lanatus* in winter and spring in western Oregon and the adjacent area of Washington; *S. tritici* Rob. var. *lolicola* Sprague & A. G. Johnson n. var. on *Lolium perenne* and *L. multiflorum* in eight Oregon counties, and *S. loligena* n. n., a short-spored fungus on *L. multiflorum*, recovered near San Francisco in 1942: *S. calamagrostidis* f. *koeleriae* (Cocc. & Mor.) n. comb., producing an obscure leaf spot on *Koeleria cristata* in eastern Oregon, Washington, and Wyoming; *S. spartinae* (Trel.) n. comb. on *Spartina gracilis* in Utah and *S. pectinata* in South Dakota; *S. bromi* Sacc. var. *phalaricola* n. var. on reed Canary grass (*Phalaris arundinacea*) at the John Jacob Astor Experiment Station, Oregon, in 1934; *S. macropoda* Pass. var. *grandis* n. var. on nine species of *Poa*; and *S. pacifica* n. sp. on *Elymus mollis* in a restricted coastal region of Oregon, collected in 1935.

In determining species and their subdivisions the author is guided by the following considerations. The size and septation of the pycnospores is dependent on the weather, as are the colour, position, shape, and size of the pycnidia. The length to width ratio of the pycnospores is considered to be of taxonomic significance. Consistent, slight morphological variations are used only for making forms or races. Host range is not given the importance it has in more actively parasitic groups, although *Septoria* species tend to be restricted sometimes to certain grass tribes. Variations in pathogenicity are not given, therefore, critical consideration and pure cultures unless of the same age are considered to show little.

There is a key for distinguishing *Septoria* from related genera and for determining the species, with a bibliography of 122 authorities, an alphabetical list of hosts with their species of *Septoria* and occurrence in the western United States, and host and fungus indexes.

Schultz (H.). **Arbeitsmethoden bei Kultur- und Infektionsversuchen mit Pythium-Arten.** [Techniques for culture and inoculation experiments with *Pythium* species.]—*Zbl. Bakt.*, Abt. 2, cv, 14–16, pp. 248–254, 1942. [Received May, 1946.]

In connexion with extensive studies on lupin foot rots in Germany, in progress since 1938, the writer worked out experimental methods for the large-scale isolation, culture, and pathogenicity tests of the numerous strains of *Pythium debaryanum* and other species associated with the disease-complex [*R.A.M.*, xxii, p. 161; cf. also ibid., v, p. 34].

Guyot (A. L.). **Contribution à l'étude des formes de Puccinia rubigo-vera (DC.) Winter 1884 sensu lato (2e note) : observations morphologiques et biologiques sur les formes parasites des Bromus (note complémentaire).** [Contribution to the study of the forms of *Puccinia rubigo-vera* (DC) Winter 1884 *sensu lato* (2nd note): morphological and biological observations on the forms parasitic on *Bromus* (supplementary note).]—*Ann. Éc. nat. Agric. Grignon*, Sér. 3, ii, pp. 75–123, 8 figs., 1940–41. [Received January, 1946.]

In summarizing the results of critically annotated studies (continued from *Ann. Éc. nat. Agric. Grignon*, Sér. 2, i, pp. 67–74, 1937, and *Uredineana*, i, 1938), which

are fully tabulated and supplied with a bibliography of 49 titles, the author considers the various morphologic forms and physiologic races of rusts on *Bromus* spp. assigned to *Puccinia rubigo-vera* sensu lato [*R.A.M.*, xii, p. 499]. He recognizes two distinct morphologic types of rust on *Bromus*, both of which he assigns to the group-species *P. dispersa*: a brachysporous type with teleutospores squat and broad both above and below, and a dolichosporous type with teleutospores thin and tapering, particularly in the lower cell. He considers it doubtful that *P. glumarum* attacks *Bromus*.

Under *P. dispersa* sensu lato on *Bromus* two geographic groups are recognized: a European group including *P. bromina*, *P. madritensis* (both brachysporous, the former very doubtfully present in North America), *P. bromi-maximi* n. sp., the f. spp. *lithospermi* n. comb. and *symphyti-bromorum* n. comb. of *P. dispersa*, and the f. spp. *bromi-erecti* and *bromi-benekenii* n. f. of *P. alternans*; and a group essentially North American including *P. dispersa* f. sp. *phaceliae*, n. comb., *P. alternans* f. sp. *bromi-porteri*, and *P. bromicola* (Mains) n. comb. with the f. spp. *typica* n. comb., and *arthuri* n. comb. Apart from *P. dispersa* and its forms (in the narrower sense, and with teleutospore shape uncertain), the last-named rusts have dolichosporous teleutospores.

The aecidial hosts and relations of these various rusts on *Bromus* are also considered.

Common fungus diseases.—*J. Dep. Agric. S. Aust.*, lxix, 5, pp. 209–211, 4 figs., 1945; 7, pp. 296–297, 4 figs., 1946.

In the first of these further papers in the present series [*R.A.M.*, xxv, p. 218] notes are given on the symptoms and control of prune rust (*Puccinia pruni-spinosae*) [ibid., xxiii, p. 262] and brown rot (*Sclerotinia fructicola*) [ibid., xxiii, p. 166; xxiv, p. 492] of stone fruits in South Australia. The former is generally present, but regular control is required only where consistent early leaf-drop spoils the ripening fruit, or where peaches invariably show fruit blemish. The fungus appears to overwinter chiefly in pustules remaining on the bark of twigs. Pink-bud Bordeaux spray and sulphur or copper cover sprays are recommended.

The second contribution deals with silver leaf disease [*Stereum purpureum*: ibid., xxiv, p. 153] of stone and pome fruits and apricot gummosis [ibid., xxiv, p. 455]. The latter, very common in non-irrigated areas in South Australia, is due to a fungus [? *Cytosporina* sp.: ibid., xviii, p. 121]; control consists in excising limb infections in summer, disinfecting the wounds with Bordeaux mixture paste, and then painting them with lead base oil paint. Infection may extend from 6 in. to 3 ft. below the gum, so that succcessive cuts should be made until the sap rises evenly all round the stem. Trunk infections are irremediable. All pruning tools should be frequently disinfected with 5 per cent. formalin. As much summer pruning as possible should be done.

Modlibowska (Irena). **Frost injury to Apples.**—*J. Pomol.*, xxii, 1–2, pp. 46–50, 6 figs., 1946.

Three types of frost injury to apples [*R.A.M.*, xxiii, p. 393] are described, (*a*) loosening of the skin, (*b*) radial splitting of the cortex always accompanied by (*a*), and (*c*) discoloration of the ovules and placenta. The first was the primary and the most common injury but the fruitlets usually recovered in three days. Radial fracturing, which was usually fatal, occurred between the vascular strands and often extended from the subepidermal split to the pith. Recovery from internal discoloration depended not only on its degree and extent but on the nutritional status of the affected fruits, as was shown by the greater recovery in thinned clusters.

Red Victoria was most severely affected by these frost injuries and of the 14 Canadian varieties examined McSweet and Forpear showed most damage and Linda the least, but in no case was the final yield greatly reduced.

Moore (M. H.) & Pearce (S. C.). **The personal factor in routine spraying. I. A preliminary trial on Apple scab.**—*J. Pomol.*, xxii, 1–2, pp. 62–68, 1946.

The considerable variations in the results of spraying for the control of *Venturia inaequalis* [*R.A.M.*, x, p. 37; xv, p. 588], in so far as they are often due to unequal applications of the spray (parts of a tree, particularly large ones, may, for example, escape treatment) led the authors to conduct in 1943 an experiment on 30 trees of bush Bramley's Seedlings of an average height of 15 ft. and spread of 22 ft. and about 30 years old, disposed in six plots of five trees each. Three plots were sprayed (average 4 gals. per tree) in the usual way by a farm hand and three subjected to a most thorough spraying (6 to 7 gals. per tree) by one of the writers. The results, as shown by percentage infection of leaves in June and fruits in September, proved beyond doubt that thorough spraying does reduce variability in scab control. In commercial spraying there is a limit beyond which thorough spraying would be uneconomic, but where the incidence of *V. inaequalis* continues to present a problem in spite of a good spraying programme with an effective fungicide, improvement by more thorough spraying would be profitable. Where good, though incomplete, control is being achieved, it may be as well not to attempt more. Variations in the efficacy of routine spraying by individual workers were brought out by the experiments and it is thought desirable that in experimental work one person should be left to do the spraying and, where more than one is required, the work should be distributed among them so that each is responsible for a block, row, or column.

Palmiter (D. H.). **Ground treatments as an aid in Apple scab control.**—*Bull. N.Y. St. agric. Exp. Sta.* 714, 27 pp., 4 figs., 1 graph, 1 diag., 1946.

These experiments continue and amplify those begun in 1937 [*R.A.M.*, xvi, p. 470] and show that 12 per cent. sodium nitrate or ammonium sulphate or $\frac{1}{2}$ to 1 per cent. elgetol will kill or prevent the discharge of 90 to 100 per cent. of the ascospores of *Venturia inaequalis* in laboratory tests, and reduce the primary inoculum of heavily scabbed orchards sufficiently to make the control of the disease with a wettable sulphur programme [ibid., xxiv, pp. 63, 443] relatively easier. Summer spraying may prove inadequate without such an effective ground spray, thoroughly applied before the green-tip stage. Elgetol at 2 qts. per 100 gals. gave great control of scab in the heavy-rainfall seasons of 1943 and 1945, 500 to 600 gals. spray per acre being required to give adequate coverage. Ground sprays must, however, be regarded as an adjunct of foliage sprayings, and in no wise as a substitute, but the latter may be reduced in concentration and number if ground treatment has been used. Conversely, effective summer spraying which reduces leaf infection to less than 5 per cent. obviates the necessity for subsequent ground treatment.

Wormald (H.). **Pear blossom blight.**—*J. Pomol.*, xxii, 1–2, pp. 41–45, 8 figs., 1946.

A bacterial blight of pear blossom [*R.A.M.*, xi, p. 57; xvi, p. 328], first causing appreciable damage in south-east England in 1929, has frequently recurred during the past 15 years. The incidence of the disease has been most marked when, on the approach of blossom time, there were periods of cold, wet weather. At the same time, in the much drier spring of 1942, when there was little blossom blight, blackened flower trusses, and others which were not discoloured, were covered with a viscous film, by which some buds were sealed up. This attack was considered to result from injuries by the apple blossom weevil [*Anthonomus pomorum*], which are thought to have provided channels for penetration by the blossom-blight infection, inoculation experiments having shown it to be most commonly present where the

outer tissues had been injured. The symptoms varied from black spots or bands on the receptacle, although styles and disk remained normal, to complete blackening round the receptacle and down the pedicel; the peduncle may be blackened and the whole truss withered. Although usually confined to the young tissues of the current year's growth, the disease sometimes invades the older tissues of the spur and on one occasion reached the branches and formed cankers. The most susceptible varieties are Durondeau, Pitmaston Duchess, Marie Louise, and Catillac, although many others suffered severe attacks.

The colonies most frequently obtained (type A) when isolations were made from the bacterial exudate released when the tissues of the blackened parts were squeezed out in water, all exhibited radial lines under miscroscopic observation. Surface colonies of these are raised and almost hemispherical after two or three days, embedded colonies being lenticular and rather dense, and those where the medium rests on the dish, thin and delicate.

Another type of colony (B) had no (or insignificant) radial lines, being minutely granular, almost flat, but sometimes umbonate; and one isolation gave similar colonies having a yellowish tint (C). Inoculation experiments with A, B, and C proved all three to be pathogenic, and type A disclosed characters similar to those of *Pseudomonas prunicola*. Isolates showing similar characters have been obtained not only from infected flowers but also from pear leaf spots and fruit spots which are an unusual symptom of the disease. Inoculations through punctures into pear fruits, either on trees in the field or in a moist chamber, produced in a few days black, slightly sunken, saucer-shaped lesions comparable with those caused by an organism isolated in 1936 from spotted Fertility pears in north Kent, the only other occasion on which bacterial spotting of pear fruits has been seen. Further cultural and inoculation experiments encouraged the conclusion that the A-type pear blossom-blight organism (Group No. 211.2322033) is indistinguishable from *P. prunicola*. The identity of types B and C has not been determined although C may be *P. cerasi*. All three show certain differences from both *P. nectarophilum* and *P. barkeri*. The author adds that eight isolates from pear, five of which were of the A (*prunicola*) type, two of the C type, and one a Lister Institute culture of *P. barkeri*, were submitted by him to Oxford (*Nature, Lond.*, cliv, p. 271, 1943) who included them all under *P. syringae*.

It is thought that these organisms may either overwinter in the dead spurs and be precipitated by rain on to the bursting flower buds, or light on the bud in the development stage, in the spring, and pass the summer and winter there. It is important to remove all infected inflorescences as soon as possible after the presence of the bacteria has been diagnosed because of their prolific multiplication in the tissues; to take measures against insects likely to puncture the flowers and give access to bacteria, and to guard against the accumulation of moisture on the opening buds by keeping the trees open by careful pruning.

Bohn (G. W.) & Maloit (J. C.). **Inoculation experiments with Pseudomonas ribicola.**—*Phytopathology*, xxxv, 12, pp. 1008–1016, 1 fig., 1945.

Ordinary methods of inoculation resulted in scanty infection by *Pseudomonas ribicola* on currant leaves, or alternatively in atypical symptoms. On the other hand, inoculum rubbed with fairly stiff brushes and cotton pads on leaves dusted with 300-mesh carborundum yielded abundant infection of a type comparable to those observed in nature, while intermediate numbers of lesions developed on foliage sprayed with bacterial suspensions after carborundum dusting. It is concluded from these results, in conjunction with field observations in Wyoming, that *P. ribicola* is a wound parasite normally entering currant leaves through the minute injuries inflicted by buffeting against other leaves and branches in the wind, and by driving sand and sleet.

Campacci (C. A.). **A podridão mole do Abacaxi.** [Pineapple soft rot.]—*Biológico*, xii, 3, pp. 70–71, 1946.

Prophylactic measures recommended against soft rot (*Ceratostomella paradoxa*), a troublesome and prevalent disease of the pineapple in São Paulo, Brazil, include care in the collection, transport, and packing of the fruits to avoid bruising and injury; removal from the field after harvesting of rotten debris, also of alternate hosts of the fungus, such as sugar-cane, banana, and mango, to suppress the development of new infection foci; procurement of planting material exclusively from healthy sites; and disinfection of the cut ends of the scapes with a mixture of 25 gm. benzoic acid and 1,000 c.c. 30 per cent. alcohol.

Jenkins (Anna E.). **Historical records of Avocado scab in Florida.**—*Yearb. Calif. Avocado Ass.*, 3 pp., 2 figs., 1939. [Received May, 1946.]

Of four excellent photographs, presented with a brief note, two, taken at the United States Department of Agriculture in 1915, constitute the earliest record of the avocado scab disease (*Sphaceloma perseae*), [*R.A.M.*, xiii, p. 386] and depict diseased Trapp avocado fruit sent by W. J. Krome from Florida in 1915. The two others illustrate the disease on avocado in Florida in 1937. A photograph by Krome showing misshapen leaves and characteristic lesions of avocado scab on a seedling in Cuba in 1916 was too faded for publication. These 1915 and 1916 photographs however, establish beyond doubt the presence of avocado scab disease in Florida and Cuba over 30 years ago.

Cavalli (L.) & Ciferri (R.). **Results of the statistical analysis of six distributions of germination percentages of conidia of Alternaria, tenuis type.**—*Int. Bull. Pl. Prot.*, xix, 11–12, pp. 92M–100M, 1945.

Ciferri (R.) & Cavalli (L.). **Estimation of toxicity by the toxicity curve method according to Prigge and Schaefer.**—Ibid., xx, 1–2, pp. 3M–8M, 1946.

These are English versions of two Italian papers already noticed from another source [*R.A.M.*, xxv, pp. 222–223], the second paper being slightly condensed.

Lugeon (A.). **Action des brassages sur les bouillies anti-parasitaires.** [Action of agitation on anti-parasitic mixtures.]—*Rev. hort. suisse*, xix, 3, pp. 64–65, 1946.

At the instance of a firm of motor-sprayer manufacturers, experiments were conducted at the Laboratory of Chemistry of the Canton of Aargau, Switzerland, to determine the effect of the oxidation produced by agitation with an air pump on the composition of two brands of lime-sulphur, viz., sulfo Maag and schwefyl (1, 2, and 10 per cent.) made up to the requisite quantity of 400 l. with (*a*) tap or spring and (*b*) distilled water.

The following are among the conclusions reached. Precipitates are formed before agitation on the mixture of lime-sulphur with tap or spring water. The limestone in the water combines with the polysulphides of the lime-sulphur to form water-insoluble calcium sulphides, which are independent of the duration of agitation (15 to 90 minutes) or the volume of air (2·1 to 12·5 l.) utilized for this purpose. The use of distilled water resulted in perfectly clear solutions without a trace of precipitate, as also did that of the pure lime-sulphur of commerce. The precipitates are attributable exclusively to the calcium carbonate content of the water. These observations are of considerable practical importance in view of the high limestone content of many springs, notably in the foothills of the Jura, the water from which is unsuitable for the preparation of lime-sulphur mixtures and should be replaced by rain water.

NICKERSON (W. J.). **Inhibition of fungus respiration: a metabolic bio-assay method.**—*Science*, N.S., ciii, 2677, pp. 484–486, 1 graph, 1946.

An attempt is shown to provide convenient methods for quantitatively assaying the immediate effect of a chemical on a mycelial organization of a fungus [cf. *R.A.M.*, xviii, p. 753]. *Trichophyton gypseum*, *T. rubrum*, and *Epidermophyton floccosum* were used as test fungi and the influence of several classes of chemicals under different environmental conditions on the oxygen consumption by the fungi was determined by means of the volumetric micro-respirometer described by Scholander and Edwards (*Rev. sci. Instrum.*, xiii, pp. 13, 292, 1942). Mercury, silver, and zinc salts depressed respiration to a comparable extent; cadmium compounds had little effect. *E. floccosum* did not recover after exposure to 1/100 zinc chloride for three hours and clinical trials showed the substance to be of promise in the treatment of tinea cruris and tinea glabrosa. The application of the method is not limited to the dermatophytes.

GOTTLIEB (S.) & MARSH (P. B.). **Quantitative determination of phenolic fungicides.**—*Industr. Engng Chem.*, Analyt. Ed., xviii, 1, pp. 16–19, 5 graphs, 1946.

The colour reaction of 4-aminoantipyrine with the textile mildew-preventive 2, 2′-methylenebis (4-chlorophenol) in the presence of potassium ferricyanide and dilute sodium carbonate was found adaptable to quantitative analysis for this phenolic substance and has been used for its determination in fabric.

McDONALD (J. E.) & FRAPS (G. S.). **Commercial insecticides and fungicides in Texas, 1944–1945.**—*Circ. agric. Coll. Tex.* 108, 15 pp., 1945.

This circular provides users of commercial insecticides and fungicides in Texas with information on the State law governing their sale, the analysing of samples for individuals by inspectors of the State Department of Agriculture, the labelling requirements, and the colouring of poisons. A list of and information concerning ingredients claimed to be present is given and the annual publication of analyses required by law is appended.

INGOLD (C. T.). **Genetics of the microfungi.**—*Nature, Lond.*, clvii, 3993, pp. 614–616, 1946.

This is a critical review and discussion of some outstanding contributions to the study of genetics in the microfungi, beginning with the discovery of conjugation in a fungus by Ehrenberg in 1818 and referring to a number of important landmarks in the history of the subject between that date and the present time.

Plant diseases. Instructions for collecting and despatching specimens.—*Rhod. J. Agric.*, xliii, 1, pp. 4–5, 1946.

These recommendations to growers wishing to send diseased plants for diagnosis to the Rhodesian Department of Plant Pathology include the desirability of submitting several representative specimens gathered on or the day before dispatch. Advice is given on packing leaves, fruits, and tubers, and on pulling and packing roots, and a specimen form is reproduced whereon full particulars of the plant, its history, and conditions of growth may be designated.

DE URRIÉS Y AZARA (M. J.). **Un sencillo aparato para aislar esporas.** [A simple apparatus for spore isolation.]—*An. Jard. bot. Madr.*, v, pp. 133–139, 4 diags., 1945.

The author describes a simple method of isolating single spores. The apparatus may be used in two ways. In (A) a needle is attached to the objective of a microscope

and the tip moved into focus. After sterilization the needle is lowered on to a slide bearing spores and a single spore captured on the tip. It is then sown on agar. In (B) a glass rod is affixed to the objective with a needle at its tip which is directed upwards to the under side of the cover slip, whence a spore is detached from the mass and transferred to the medium.

Stakman (E. C.) & Christensen (C. M.). **Aerobiology in relation to plant disease.**—*Bot. Rev.*, xii, 4, pp. 205–253, 1946.

This paper, which includes a bibliography of 151 titles [cf. *R.A.M.*, xxiii, p. 139], discusses the adaptation of fungi to aerial dissemination, [ibid., xxiv, p. 378], the quantities of spores and devices that facilitate their production and release, spore wastage, size in relation to altitudes reached by spores, their rate of fall [ibid., xxiii, p. 310], theoretical dispersal distance, local and long-distance dissemination, and longevity. In relation to the two last-named, rusts of oats (*Puccinia coronata* and *P. graminis*) and leaf [brown] (*P. triticina*) and stem [black] (*P. graminis*) rusts of wheat in the United States, and cereal rusts in Europe, North Africa, and India are treated in detail. The paper concludes with a discussion on the range of the projection of viable spores by wind, and the dissemination of physiologic races of *P. graminis* in the United States and Mexico.

Trinchieri (G.). **Air transport and phytosanitary control.**—*Int. Bull. Pl. Prot.*, 1–2, pp. 1–16, 1945.

The notable advance in air transport all over the world has made increasingly imperative an international plant quarantine service. In this paper, written before the war had come to an end, the dangers from the dissemination of disease organisms carried by air-borne transport and actual records of such transference are clearly set out, based largely on official sources of the United States quarantine service. A staff of plane inspectors who will make full records of organisms found, the results of which should be fully publicized, is suggested. Insecticidal mixtures for spraying aeroplanes are reviewed, but no specific fungicidal agent is given, although disinfection with those of recognized efficacy is recommended.

Johnson (M. J.), Stefaniak (J. J.), Gailey (F. B.), & Olson (B .H.). **Penicillin production by a superior strain of mold.**—*Science*, N.S., ciii, 2678, pp. 504–505, 1946.

Yields of penicillin greatly exceeding those produced by *Penicillium chrysogenum* No. 1951-B25 were obtained from an X-ray mutant of this culture designated X-1612 [see next abstract]. The maximum yield of the mutant amounted to 557 units per ml. compared with 245 for the parent.

Koffler (H.), Knight (S. G.), Frazier (W. C.), & Burris (R. H.). **Metabolic changes in submerged penicillin fermentations on synthetic media.**—*J. Bact.*, li, 2, pp. 305–316, 2 graphs, 1946.

The addition of the ash from maize steep (3 per cent.) to a medium consisting of lactose, dextrin, and mineral salts caused a remarkable increase in penicillin yields in shake-flask fermentations [*R.A.M.*, xxv, p. 130 and next abstracts], which was further enhanced by the incorporation of 0·05 per cent. phenylacetamide. A slight stimulus to penicillin production may also be given by 0·13 per cent. boric acid. Moreover, *Penicillium chrysogenum* X-1612 [see preceding abstract] on maize steep media utilized sugars and ammonia more rapidly than did the controls without this supplement.

MOYER (A. J.) & COGHILL (R. D.). **Penicillin. VIII. Production of penicillin in surface cultures. IX. The laboratory scale production of penicillin in submerged cultures by Penicillium notatum Westling (NRRL 832).**—*J. Bact.*, li, 1, pp. 57–93, 1 graph, 1946.

Several culture methods can be utilized for the inducement of sporulation by *Penicillium notatum* for the inoculation of production cultures [cf. *R.A.M.*, xxv, p. 130]. The spores grow readily on agar slants or plates, while the use of dry material, mixed with a floating or spreading agent, e.g., whole-wheat flour, has given very satisfactory results in respect of uniformity of surface growth and penicillin yield.

None of the *P.* spp. so far tested for penicillin production in surface culture has proved superior to one of the descendants of the original Fleming strain (NRRL 1249. B21), freed as far as possible from degenerate mutants, and which is now widely used in industry. The yield of penicillin produced in surface cultures by *P. notatum* has been increased from between 2 and 6 to over 200 units per ml. Production is greatly stimulated by the addition to the medium of maize steep liquor (0·5 per cent.) [see preceding abstract], while lactose or starch were found to be more favourable to penicillin development than glucose, sucrose, sorbitol, or glycerol. Yields of 190 units per ml. have been secured in five days by the use of NRRL 1249. B21 in a medium containing maize steep liquor and lactose, with a further increase up to 220 units per ml. from the addition of nutrients during the course of fermentation (0·20 gm. each lactose and glucose, 0·010 gm. maize starch, and 0·050 gm. maize steep liquor per ml. daily from the fourth day). Penicillin yields of 112 units per ml. have been obtained in six days by the use of a pre-germinated ('pellet') inoculum, prepared by developing mycelium from spores, in submerged culture, in a medium containing, besides the standard nutrient salts, 30 gm. lactose and 55 ml. maize steep liquor per l. After two to three days on the Ross-Kershaw shaker, the 'pellets' were 0·5 to 1 mm. in diameter and the solution had a penicillin content of 8 to 10 units per ml. and a P_H of 7·6 to 7·8.

WHALLEY (MURIEL E.). **Abstracts on penicillin and other antibiotic substances.**—166+19 pp., Ottawa, National Research Council of Canada, 1945. $1.00. [Mimeographed.]

This is a second edition, revised and supplemented, of abstracts taken from various sources from 1917 to 1944 [*R.A.M.*, xxiv, p. 27].

BRIAN (P. W.), CURTIS (P. J.), GROVE (J. F.), HEMMING (H. G.), & MCGOWAN (J. C.). **Gladiolic acid; an antifungal and antibacterial metabolic product of Penicillium gladioli McCull. and Thom.**—*Nature, Lond.*, clvii, 3995, pp. 697–698, 1946.

The authors report the isolation of a substance named gladiolic acid from culture filtrates of *Penicillium gladioli* [*R.A.M.*, vii, p. 448], yields as high as 300 mgm. per l. having been obtained. Gladiolic acid inhibited the growth of *Staphylococcus aureus* at P_H7 at 250 μgm. per ml., but was much more markedly fungistatic, a concentration of 2 μgm. per ml. at P_H 3·5 preventing the germination of *Botrytis allii* conidia, whereas at P_H7 a concentration of 100 μgm. per ml. was required.

LE PAGE (G. A.) & CAMPBELL (ELIZABETH). **Preparation of streptomycin.**—*J. biol. Chem.*, clxii, 1, pp. 163–171, 1 graph, 1946.

A relatively simple procedure for the production of streptomycin [*R.A.M.*, xxv, p. 308] in surface cultures on a yeast extract medium fortified with minerals is described, and a new method for the purification of the antibiotics thus obtained is outlined. The resultant products have a potency of 350 to 450 S units per mg.

DILLER (VIOLET M.), TYTELL (A. A.), & KERSTEN (H.). **Mutation of Aspergillus niger Van Tieghem by means of X-rays.**—Abs. in *J. Bact.*, li, 3, p. 404, 1946.

A mutant of *Aspergillus niger*, differing from the original culture in appearance and growth habit, was induced by irradiation with soft X-rays. At the peak of production the mutant yielded 50 per cent. more citric acid, with a lower sugar consumption, than the parent.

ARRAGON (G.), MAINIL (J.), REFAIT (R.), & VELU (H.). **La flavinogénèse par Eremothecium ashbyii, Guilliermond. Étude du facteur surface/volume.** [Flavinogenesis by *Eremothecium ashbyii*, Guilliermond. Study of the surface/volume factor.]—*Ann. Inst. Pasteur*, lxxii, 3–4, pp. 300–305, 4 graphs, 1946.

Riboflavin (vitamin B_2) production by *Eremothecium ashbyii* [*R.A.M.*, xxv, p. 213] was three or four times more abundant in surface cultures on solid or semi-solid media than in those immersed in liquids (343, 321 to 360, and 426 mg. per mille, respectively, on 5, 10, and 15 per mille agar compared with 107 in bouillon). The yields reached a peak on the ninth to tenth day in the solid series and on the 15th in the liquid.

STEWART (F.), SCALF (R. E.), & STARK (W. H.). **Submerged culture of moulds for amylase production.**—Abs. in *J. Bact.*, li, 3, pp. 401–402, 1946.

The use of surface mould cultures for amylase production is normally attended by a serious drawback in the form of bacterial contamination. This has been obviated at the plant of Joseph E. Seagram & Sons, Inc., Louisville, Kentucky, by the development of a submerged culture technique specially adaptable for use in the conversion of grain mashes in a continuous fermentation process [cf. *R.A.M.*, xxv, p. 306]. The amyloclastic and saccharogenic values of the amylases were increased from 300 and 600, respectively, by the selection of 21 species of *Aspergillus*, *Mucor*, *Penicillium*, and *Rhizopus* and their growth under optimum conditions of medium, hydrogen-ion concentration, and aeration.

WHALLEY (MURIEL E.). **Abstracts on fungi and bacteria affecting various materials.**—228 pp., Ottawa, National Research Council of Canada, 1944. $1.50. [Mimeographed.]

These 449 abstracts on fungi and bacteria affecting textiles, leather, rubber, silk, paper, and pulp have been taken from *Chem. Abstr.*, 1907 to 1943 inclusive, and from *J. Text. Inst.*, *Manchr*, 1910 to 1943 inclusive.

LAVERS (C. G.) & ILLMAN (W. I.). **Packaging. III. Effect of mould growth and ageing on the water-vapour transmission of packaging materials.**—*Canad. J. Res.*, Sect. F, xxiv, 2, pp. 117–122, 20 graphs, 1946.

In this experiment packaging materials (*Canad. J. Res.*, Sect. F, xxiii, pp. 109–116, 1945) were dusted with spores of *Syncephalastrum racemosum*, *Paecilomyces varioti*, *Penicillium* spp., *Aspergillus niger*, *A. flavus*, *A. terreus*, *Chaetomium globosum*, and *Stachybotrys atra*, and stored at 95° F. and 95 to 100 per cent. humidity for one to five weeks. M.S.T. and M.S.A.T. cellophane suffered only light mould damage, whereas M.S.Y.T. cellophane had considerable mould growth. The heat-sealing, moisture-proof lacquer deteriorated during storage in conditions favouring optimum development of the moulds. Wax-coated materials tolerated prolific mould growth and when wax peeled from the surface of the sheet their water-vapour transmission values increased. Laminated materials having metal foil as one layer suffered little by mould growth as regards their transmission rate or by the delamination of the other layers. Most samples of kraft and glassine acquired abundant mould growth. Cellulose acetate, pliofilm [ibid., xxiii, p. 290], and vinyl-film showed negligible mould.

Bayley (C. H.) & Weatherburn (Muriel W.). **The effect of weathering on Cotton fabric containing certain copper rotproofers.**—*Canad. J. Res.*, Sect. F, xxiv, 3, pp. 193–202, 1946.

Samples of No. 8 cotton duck exposed to outdoor weathering from mid-July to mid-October, 1944, showed substantial losses in breaking strength, which were of the same order in untreated material and that impregnated with copper naphthenate [*R.A.M.*, xxiv, p. 380], copper hydroxynaphthenate, copper oleate, and copper tallate containing 0·1 to 1 per cent. copper. The treated samples showed slight evidence of increased actinic degradation from the action of the sun's rays as measured by cuprammonium fluidity. Weathering was responsible for a considerable reduction in the copper content of the treated specimens. The addition to the rot-proofer of a waterproofing compound of the wax pigment filler type helped to maintain the copper content of the exposed samples at a reasonably high level, to minimize the loss in breaking strength, and to inhibit fungal infection in soil-burial tests. The initial water resistance of the proofing was impaired by all the copper compounds except the hydroxynaphthenate, which enhanced it. It is noted that breaking-strength losses are much less in buried samples that have been previously exposed to weathering than those which have not. [This information is also presented in *Amer. Dyeest. Reptr*, xxxv, 9, pp. 218, 235-236, 1946.]

Björkman (E.). **Om skogsplanteringens markbiologiska förutsättningar.** [On the prerequisite edaphic conditions for forest planting.]—*Svenska Skogsvårdsfören. Tidskr.*, xlii, 5, pp. 333–355, 13 figs., 1944. [English summary. Received April, 1946.]

Mycorrhizal relationships appear to be an important factor in the establishment of forest plantations in northern Sweden [*R.A.M.*, xxiv, p. 465], and insufficient attention to this factor may well account for the failure of many attempts in this direction. On mediocre and relatively poor soils forest trees normally absorb their nutriment through the assistance of their mycorrhizal symbionts, whereas in a richer soil, with few mycorrhiza, root hairs or roots converted into pseudomycorrhiza may serve the same purpose.

The slow growth rate of many spruces up to the age of 10 or 20 years, associated with mycorrhizal paucity, constitutes a special problem. This species has been found to be less prone to the development of mycorrhiza than Scots pine (*Pinus sylvestris*) and more especially *P. montana*. In conformity with similar experiments in various countries not previously afforested with conifers, e.g., Western Australia, Sumatra, South America, and the North American prairies, mycorrhiza-bearing pine seedlings planted in sterile peat with a low phosphorus content grew in the course of one summer to double the size of the mycorrhiza-free controls [ibid., xvi, p. 126]. It may be concluded from these observations that plants supplied with mycorrhiza are more readily able to utilize small amounts of phosphorus in the soil than are those deprived of symbionts.

The transplanting of trees from one environment to another involves a strain on the nutritional balance of the roots, which require special treatment to fit them for their new surroundings. Thus, seedlings intended for transference to a poor soil should be given little or no fertilizer so that mycorrhiza may be formed in profusion, whereas on rich sites heavily manured plants, even without mycorrhiza, may be used. It is recommended that nurseries should be located on the same soil as that on which the seedlings are ultimately to be planted out. Plants from poor forest soil should not be transferred to manured gardens.

Reed (G. M.). **Physiologic specialization of the parasitic fungi. II.**—*Bot. Rev.*, xii, 3, pp. 141–164, 1946.

Investigations of physiologic specialization in plant pathogens, particularly

those of cereals, and to a lesser extent those of other economic plants, are reviewed over the ten years which have elapsed since the author published his first paper on this subject [*R.A.M.*, xiv, p. 648]. The additions, which have since taken place, to the physiologic races of the various fungi, together with some morphological distinctions discerned, and their geographical distribution, are mentioned, and racial tables of the cereal and other rusts, the cereal smuts, the powdery mildews, and other pathogens, together with a bibliography of 177 titles, are supplied.

Stapp (C.) & Marcus (O.). **Beiträge zur weiteren Vereinfachung der serologischen Virusdiagnose.** [Contributions to the further simplification of the serological virus diagnosis.]—*Zbl. Bakt.*, Abt. 2, cvi, 20–24, pp. 465–471, 1 fig., 1 diag., 1944. [Received May, 1946.]

Twelve successful experiments in the conservation of valuable serum for virus diagnosis are described. After a preliminary treatment for the elimination of antibodies against healthy plant protein by the addition of uninfected tobacco or potato leaf extract and subsequent withdrawal by centrifugation of the precipitate thus formed, the antisera against potato viruses X, Y, and A [see above, p. 322] were dried on blotting-paper or cellulose and cut into small pieces 0·09 to 0·125 sq. cm. in area; these were introduced into the expressed plant juices to be tested on slides in place of the liquid sera. The desiccated sera were found to maintain their activity for periods of up to a year. The most effective method consisted in drying on long-fibred cellulose and conservation in the desiccator over calcium chloride. Precipitation was admittedly one degree weaker than in the controls with liquid serum, but the saving effected by the treatment is substantial, only one-tenth of the serum quantity ordinarily required being requisite.

Lutman (B. F.). **Actinomycetes in various parts of the Potato and other plants.**—*Bull. Vt agric. Exp. Sta.* 522, 72 pp., 35 figs., 1945.

The results of the author's histological investigations [cf. *R.A.M.*, xxi, p. 38] to determine the filamentous nature of the irregular lines resembling cell walls observed microscopically in sections of potato confirmed his view, in the light of the known occurrence of Actinomycetes in the outer layers of roots and tubers, and of the morphological resemblance of these filaments to *Actinomyces* strands and their protein nature, that they represent *Actinomyces* mycelium. Their abundance in the external layers of potato tubers and roots and in the aerial stems, their presence in leaves along the phloem of the veins and generally in the flowers and seedlings seemed to indicate a phenomenon of systemic and hereditary nature. Their invasion of the intercellular spaces of the abcission swelling at the outer margin of a swollen area on the pedicel invites the conclusion that an *Actinomyces* sp. might precipitate blossom-drop under stimulus such as undue heat by premature disintegration of the intercellular pectins. Their rapid penetration of regenerated cork cambium cells, their association with scab (*A. scabies*) lesions and extension from the abnormal cells of the cork cambium to the heart of the tuber, and their presence in clean tubers from clean land, demonstrate their universal occurrence. Similar Gram-positive filaments are present in the cell walls of Jerusalem artichoke [*Helianthus tuberosus*] tubers and enlarged roots of beets, carrots, parsnips, and turnips. It is also suggested that leaf roll, the foliage stage of tuber net necrosis, is due to the effect of these filaments.

Jackson (A. W.) & Henry (A. W.). **Occurrence of Bacillus polymyxa (Praz.) Mig. in Alberta soils with special reference to its pathogenicity on Potato tubers.**—*Canad. J. Res.*, Sect. C, xxiv, pp. 39–46, 2 pl., 1946.

Bacillus polymyxa, isolated from a variety of soils, is presumed to be a widely distributed soil organism in Alberta. The 20 isolates and other strains from culture

collections all caused rotting of potato tubers and slices [*R.A.M.*, xxii, p. 493], when introduced through wounds, under conditions of abundant moisture and high temperature (up to 45° C. but not below 30° for the tubers or 20° for the slices). Consequently, in spite of its wide distribution, it is not anticipated that it will be a serious cause of rotting in the field, since soil temperatures in Alberta are too low (occasionally those near the soil surface may reach favourable levels), but it may be of more importance under storage conditions, especially in conjunction with other organisms. *B. polymyxa* was isolated several times from rotted tubers but it was never the sole causal organism of the rotting. When freshly cut tubers were buried in moistened Edmonton soils in pots at 20° to 25° they became infected after four to six days, usually in combination with other bacteria and fungi. At recommended storage temperatures no damage from the organism should occur.

WHITEHEAD (T.), McINTOSH (T. P.), & FINDLAY (W. M.). **The Potato in health and disease.**—Second edition—xv+400 pp., 11 pl., 13 figs., 2 diags., Edinburgh & London, Oliver & Boyd, 1945. 25*s*.

Chapters XII to XX of this manual deal with potato diseases arranged under the systematic groups of the causal organisms. The introductory chapter (XII) gives a two-page key for the identification of the diseases and disorders, and a table showing the systematic relationships of the causal organisms. Each disease is treated fully under the following headings: general appearance (with photographs), symptoms of other diseases with which it might be confused, distribution, description of the causal organisms, losses, and control. A chapter is given to diseases and conditions of uncertain origin, while virus diseases are treated in three chapters under the headings mentioned above and with special reference to the deterioration and degeneration of potato stocks. The spread of viruses and their identification are treated fully: the reactions of common potato varieties to them are tabulated in the appendix. The latter also gives fungicidal treatments of growing plants and tubers, and descriptions of 53 varieties in which are included remarks on their reactions to diseases. Bibliographical references to the phytopathological sections are given.

BALDACCI (E.). **The presence in Italy of Fusarium moniliforme on Rice and its phytopathological signification.**—*Int. Bull. Pl. Prot.*, xx, 1–2, pp. 1M–2M, 1946.

With reference to the report by Elisei of *Fusarium moniliforme* (*Gibberella fujikuroi*) [*R.A.M.*, xviii, p. 54] on rice in Italy, the author states that the fungus was also reported on the same host in Italy by Cattaneo in 1877 under the name *F. heterosporum*. The disorders attributed to the fungus in Italy take the form of collar rot only. Locally, only 1 per cent. of the rice plants are attacked. Experimental infections indicated that the Italian strains are of average pathogenicity. The optimum temperature for infection was ascertained to be 35° C., a figure only very rarely reached in the rice-growing areas of Vercelli and Pavia. The climatic conditions in Italy also do not favour infection in other respects. There was no difference in morphological characters between the Italian and tropical strains. The perfect state (*G. fujikuroi*) was not found in Italy, but in culture on agar-agar perithecial rudiments were observed once.

It is concluded that the pathogenic activity of the organism depends on special climatic and cultural conditions not so far found in Italy.

CAMPBELL (W. A.) & SLEETH (B.). **Variability of Pythium ultimum from Guayule.**—*Mycologia*, xxxviii, 1, pp. 24–39, 2 figs., 1946.

The failure of 24 out of 51 isolates, during studies of the root rot disease of guayule (*Parthenium argentatum*) caused by *Pythium ultimum* [*R.A.M.*, xxv, p. 43], to produce the oogonia and antheridia required for their reference to this genus has

led the authors to investigate the variability in spore formation of 121 *P. ultimum* isolates.

Of those grown on maize-meal agar, three were classified as type O on the ground of their producing chiefly oospores; 71, producing oospores and more or less sporangia, were classed as type OS; and 47, producing only sporangia, as type S. Subcultures from 3 O, 11 OS, and 7 S types proved similar to the parent cultures; 4 OS type isolates segregated for types O and S, respectively, and two for types OS and S, suggesting that these four isolates were mixed cultures or unstable as to type.

Attempts on various media to produce oospores on S type isolates failed. Rates of growth on maize-meal agar at temperatures ranging from 10° to 40° C. were similar for 5 O, 13 OS, and 11 S types of hyphal-tip subcultures of 25 isolates and corresponded to those previously recorded for *P. ultimum* [ibid., xxii, p. 373], a temperature between 25° and 30° being optimal for mycelial growth. Twenty-six subcultures including all three types developed much the same degree of virulence as pathogens causing pre-emergence loss in guayule seedlings. While most hyphal-tip or single-spore subcultures proved stable, successive hyphal-tip transfers of a hyphal-tip subculture of one isolate, 980, of the OS type, produced both the O and S types as well as the parent type.

It is concluded, therefore, that the species *P. ultimum* represents a number of strains diverging in their ability to generate either oospores, or sporangia, or both, the production of oospores and sporangia by a particular strain being roughly constant and likely to persist indefinitely on hyphal-tip or single-spore transfers. It is suggested that the homothallic nature [ibid., xviii, p. 472] of the fungus and the absence of anastomoses in the mycelium offers an explanation of this stability in many strains of *P. ultimum*. Where variation occurs, as in the case of the oospore-sporangia type, notably those from isolate 980, it is suggested that variation may result from gene mutation or somatic segregation, inducing a heterocaryotic condition [ibid., xviii, p. 497; xxii, pp. 250, 538].

STANER (P.). **Les maladies de l'Hévéa au Congo belge.** [*Hevea* diseases in the Belgian Congo.]—*Mém. Inst. roy. colon. belge*, xi, 6, 42 pp., 6 figs., 1941. [Received June, 1946.]

The author summarizes the available information on the following pathogens affecting *Hevea* rubber and their control in the Belgian Congo [*R.A.M.*, xi, p. 2]: agents of root rots, *Fomes lignosus* [ibid., xii, p. 80]; *Ganoderma pseudoferreum*, *F. noxius*, *Ustulina zonata*, and *Sphaerostilbe repens*; stem diseases, brown bast and *Phytophthora palmivora* cankers; branch rots caused by *Corticium salmonicolor* and *U. zonata*; leaf infections associated with *Oidium heveae*, *Helminthosporium heveae*, and *Ascochyta heveae*; and moulds on the smoked sheets [ibid., xviii, p. 272 *et passim*].

WEINDLING (R.). **Microbial antagonism and disease control.**—*Soil Sci.*, lxi, 1, pp. 23–30, 1946.

The two experimental approaches at present used to investigate possible improvements in microbial control of soil plant pathogens are recalled, viz., inoculation of soils with specific organisms and the provision of soil amendments favouring the antibiotic functions of the existing microflora. The second is the only one widely and successfully used.

The principles underlying biological control put forward by Thompson (*Parasitology*, xxi, pp. 269–281, 1929) as a result of entomological studies are found to serve for plants and are discussed in that light.

The means of control of two soil invaders, *Ophiobolus graminis*, which does not form special perennating bodies, and *Phymatotrichum omnivorum*, which produces resistant sclerotia, are contrasted. The former is eradicated fairly rapidly by

organic amendments [*R.A.M.*, xviii, p. 476; xxii, p. 129], the precise nature and action of which are still under debate. The latter is reduced by long, continuous treatment with organic materials, with or without deep ploughing, the micro-organisms destroying the germinating sclerotia. The application of the organic material must be timed for the right period of crop development and climatic conditions to give maximum microbial activity at the crucial point.

The assessment of the complex, ever-changing, microbial influence is difficult. Attempts at analysis of the mechanism serve as a useful pointer to a promising approach to an understanding by the setting-up of soil microbiological indicators comparable to the phyto-indicators used in plant ecology.

WALKER (J. C.). **Soil management and plant nutrition in relation to disease development.**—*Soil Sci.*, lxi, 1, pp. 47–54, 1946.

The influence of plant nutrition on the course of disease development should, in the author's submission, be made the subject of more intensive investigation both in nutrient culture and in the field.

Fusarium wilt pathogens are selected for review because of their similarity in mode of entry, effect on the plant, in their capacity to persist as free-living fungi in competition with other soil organisms, and in their selective pathogenicity. The fungistatic effect of potassium amendments [*R.A.M.*, xxi, p. 438] in the control of *F. oxysporum* var. *melonis* and the even more interesting reduction of cotton wilt (*F. oxysporum* var. *vasinfectum*) [*F. vasinfectum*] by the use of potassium salts, are cited. Further research by M. N. Walker [ibid., x, p. 241], Miles (*Bull. Mo. agric. Exp. Sta.* 23), and others illustrated the necessity of combining resistance with fertilizer treatments if successful control was to be achieved on heavily infected soil. The author's studies [*R.A.M.*, xxiv, p. 484] on *F. oxysporum* var. *conglutinans* [*F. conglutinans*], causing cabbage yellows, also indicated that inherent host resistance was the limiting factor and that host nutrition and temperature exerted their effects only when resistance was partial or lacking. In the case of tomato wilt (*F. oxysporum* [*F. bulbigenum*] var. *lycopersici*) variation in nutrient concentration and ion balance gave similar results as for cabbage yellows.

A comparison between two diseases of cabbage yellows and club root (*Plasmodiophora brassicae*) [ibid., xx, p. 147] demonstrated that an increase in salt concentration of the nutrient solution depressed yellows development, while that of club root was increased. Reduction of the potassium-ion concentration increased yellows but decreased club root. Reduction of the nitrate ion decreased yellows, but club root increased whether the nitrate ion was increased or decreased, and reduction of the phosphate-ion concentration acted fungistatically on both.

The control of *Actinomyces scabies* by high soil acidity is attributed to the fungistatic effect of the H-ion upon the scab organism. The work of Schroeder and Albrecht [ibid., xxi, p. 469] and Gries *et al.* (abs. in *Phytopathology*, xxxiv, p. 1001) points to the probable influence of the P_H in modifying the calcium-ion concentration in the soil and so altering the calcium : potassium ratio. The same may be true for club root.

Eddins's success in the course of his studies of bacterial wilt of potatoes, tomatoes, and eggplant (*Bacterium* [*Xanthomonas*] *solanacearum*) [*R.A.M.*, xv, p. 459] in increasing by 10 to 15 times the yield of eggplant and tomato crops in Florida in 1935 by adjusting the P_H by sulphur treatment followed by liming is described.

Failure of conventional liming methods to control *Plasmodiophora brassicae* in the field, although the P_H was raised thereby above 7, caused Larson and Walker [ibid., xiii, p. 669] to remove the soil to a greenhouse where, under uniformly favourable conditions of soil moisture, the pathogen was inhibited entirely. It is thought that under field conditions the lowering of the P_H of the solution immediately surrounding the roots by the release of carbon dioxide rendered the

germination of *P. brassicae* possible in spite of the high P_H level in the soil mass. The author suggests that the same might hold for potato scab.

The wide discrepancies often occurring between results in different areas suggest that large-scale soil management may fail unless based on studies of host nutrition.

JOHNSON (J.). **Soil-steaming for disease control.**—*Soil Sci.*, lxi, 1, pp. 83–91, 1946.

Soil-steaming for the elimination of pests and pathogens is followed by bad results as well as good for, while plant parasites, weed seeds, etc., may be eliminated, normal and desirable soil flora and fauna may be destroyed also; an immediate chemical action is set up by soil-steaming, which causes the partial decomposition of certain organic and inorganic materials and the formation of phytocidal substances, such as ammonia, apart from the release of materials which encourage plant growth. Biochemical, physical, and physiological changes bring about, respectively, modified ammonification, nitrification, nitrogen fixation, and denitrification; modified absorptive capacity of the soil for water, gases, and salts; and alteration in the development of lower soil organisms, in seed germination, and plant growth. Numerous examples are cited where recontamination of steam-heated soils has been heavy and the infection of subsequent crops has been much higher than in unheated soil.

GARRETT (S. D.). **Soil as a medium for transfer and multiplication of disease organisms.**—*Soil Sci.*, lxi, 1, pp. 3–8, 1946.

In this review the author, after noting the preoccupation of early workers exclusively with host-parasite relationships, traces the development of soil research, in particular that on micro-organisms, in relation to diseases up to the environmental researches of Thom and Morrow [*R.A.M.*, xvi, p. 407], whose division of soil fungi into those able to live normally in relation to soil organic matter in the chemical sense, i.e., to residual products of decomposition, and those responsible for the primary decomposition of plant and animal remains towards those residual products, is considered to have opened up an horizon full of interest for further investigations. Waksman's [ibid., xi, p. 470] and Reinking and Mann's [ibid., xiii, p. 593] work led the present author to designate as soil-invaders highly specialized parasites which die out in the soil in the absence of a host plant because they cannot compete with the soil inhabitants or saprophytes for an existence on inanimate organic matter; and to envisage a spatial and a temporal distribution of a given soil micro-organism on organic substrata [ibid., xvii, p. 625]. By 1944 Garrett had come to see the development of the root-infecting fungi as a means of escape from the bitter competition for saprophytic existence in the soil [ibid., xxiv, p. 199] and he considers them entitled to take a place analogous to that of specialized higher plant groups which have the capacity to populate inhospitable habitats. Decomposition must also be accompanied by changes in the microflora causing it, so that there is a progressive micro-organic development on these organic substrata which parallels colonization on the ground above. Surface vegetations, however, compete for space and light, whereas the subterranean succession is conditioned by the struggle for the exhaustible, and therefore, finite, substrata. The highly specialized parasite, *Ophiobolus graminis*, an example of a soil-invader, is limited to the Graminaceous hosts on which alone it can spread and multiply; and its temporal distribution is restricted saprophytically to the uncertain habitat of plant tissues it has parasitically occupied. In contrast *Fusarium culmorum* is a primitive parasite following *O. graminis* as a secondary pathogen and also colonizing healthy wheat roots and straw remaining in the soil after harvest [ibid., xix, p. 10; xxi, p. 134]. The *Rosellinia* fungi are similarly regarded as primitive parasites classed as soil inhabitants, their nutrition being predominantly saprophytic.

Daines (R. H.). **Control of plant diseases by use of inorganic soil amendments.**—*Soil Sci.*, lxi, 1, pp. 55–66, 1946.

The results [taken from 37 sources] of experiments, in which inorganic substances have been used in attempts to control soil diseases, are reviewed. Sulphur and liming materials, which act indirectly by altering the P_H, have given very conflicting results for *Actinomyces scabies* and *Plasmodiophora brassicae*, respectively. This seems to arise from complex soil reactions not at present known or understood.

Copper and mercury act directly as fungicides. Here again great variability in toxicity is encountered which may be attributed to various causes. In the case of copper it may be due to (1) soil acidity which may alter the solubility of the copper, (2) the adsorptive power of the soil constituents, (3) the presence of proteins and their decomposition products which release toxic copper but themselves depress the toxicity, or (4) the presence of calcium, magnesium, or potassium chlorides which also depress the toxicity.

The variability of mercurial action in the case of *A. scabies* is attributed to the difference in tolerance of mercury exhibited by different strains of the parasite. In other cases it is believed to be due to the ability of the soil to retain the mercury whether by virtue of its own composition or the treatments to which it is subjected.

Newhall (A. G.). **Volatile soil fumigants for plant disease control.**—*Soil Sci.*, lxi, 1, pp. 67–82, 3 figs., 1946.

The value of a cheap volatile soil fumigant for the purpose of controlling a number of plant pathogens capable of persisting in the soil for many years has long been recognized; but one or other or more of the qualities desired for an ideal fumigant of this kind are still lacking, namely, cheapness, non-inflammability, easy handling, and harmlessness to operators and equipment. Stark (Investigations relevant to the use of chloropicrin for soil fumigation, Thesis, Cornell University, 1945), using a specially devised gas-tight chamber designed to test the amount of chloropicrin gas adsorbed into the soil, showed that the clay fraction was largely the determining factor of the amount of gas adsorbable by any soil. The process was less pronounced at higher humidities, but did not appear influenced by accumulation of soil particles, P_H changes, or organic matter, present as dry muck, peat, or horse manure.

The soil fumigants in common use, viz., chloropicrin, carbon disulphide, DD mixture (a petroleum by-product with rather limited fungicidal properties), ethylene dichloride (not a good fungicide), methyl bromide (shown by the author to be capable of killing sclerotia of *Sclerotinia sclerotiorum*) and its proprietary modification dowfume G (10 per cent. methyl bromide), are reviewed and compared as regards harmfulness, costs, mode of employment, retention by the soil, and their efficacy against nematodes, weeds, and fungi. This information, together with other relevant data for these and lesser known fumigants, is summarized in a table. None of these is as effective as steam, but those which are nearly so are considerably less costly.

The paper concludes with an illustrated description of devices for applying volatile soil fumigants.

Beach (W. S.). **Pathogenic and physiogenic damping-off.**—*Soil Sci.*, lxi, 1, pp. 37–46, 1 fig., 1946.

A list is given of the plants more usually affected by damping-off and the symptomatology of the more important pathogens is shortly described. The environmental factors influencing pathogenic damping-off, viz., temperature, light, moisture, P_H, humus, and salt concentration are reviewed. From these it appears that although *Pythium*, *Rhizoctonia* [*Corticium solani*], and *Fusarium* have similar temperature ranges and optima the first-named is more prevalent in colder months

and the two latter in the summer. Soil moisture is considered to be the major factor in the causes of damping-off. If, however, soil is air-dried before use good stands are obtained even in moist soils. Damping-off pathogens are adapted to a wide P_H range, but if the plant is growing in a soil at its P_H optimum, it is able to resist or escape attack. Soil sterilization by reducing microbial competition increases the liability of plants to attack by these pathogens, which as facultative parasites benefit by the humus made available. The methods of control of damping-off are given and it is suggested that the most efficient control is obtained by combined seed-dressing, soil sterilization, and seed-bed drenches. Sand culture and the use of shredded sphagnum moss are recommended. Physiogenic damping-off may be caused by high temperatures, soil drying, excess salt concentration, and exosmosis induced by these, or conversely by waterlogging, bad aeration, or chilling. The type of injury resulting from these is often difficult to dissociate and distinguish from that due to parasites.

NICHOLAS (D. J. D.). **Detection of manganese deficiency in plants by tissue tests, using tetramethyl diaminodiphenyl methane.**—*Nature, Lond.*, clvii, 3995, p. 696, 1946.

The detection of manganese deficiency [*R.A.M.*, xxv, p. 15] by the tissue test method (associated originally with the work of Wenger and Duckert, *Helv. chim. Acta*, xxiv, p. 1143, 1941, and Szebelledy and Bartfay, *Z. anal. Chem.*, cvi, p. 408, 1936), using tetramethyldiaminodiphenylmethane, which induces a blue colour in proportion to the manganese content of the extract of the tissues, is briefly described and is expected to be the subject of a fuller report. Acetone has been found more reliable than chloroform (recommended in the original publications) as a solvent for the reagent.

ROACH (W. A.) & BARCLAY (C.). **Nickel and multiple trace element deficiencies in agricultural crops.**—*Nature, Lond.*, clvii, 3995, p. 696, 1946.

Increases in yield of wheat, potatoes, and broad bean crops are recorded by the authors in field experiments on the Romney Marshes in 1944 following spraying with solutions containing manganese, iron, boron, copper, zinc, and nickel, the increases being statistically significant and economically important with the possible exception of copper and zinc on wheat. This is thought to be the first record for Britain of a successful contribution by nickel to better crop yields and the first occasion of zinc deficiency in Britain being proved by the increase in yield as result of treatment with zinc. In experiments on potatoes showing severe symptoms of manganese deficiency applications of manganese strikingly improved the foliage without any effect on yield, zinc sulphate alone raised the yield 27 cwt. per acre, and both manganese and zinc increased the yield 78 cwt. per acre.

RICEMAN (D. S.). **Mineral deficiency in plants on the soils of the Ninety-mile Desert in South Australia. 1. Preliminary investigations on the Laffer Sand, near Keith.**—*J. Coun. sci. industr. Res. Aust.*, xviii, 4, pp. 336–348, 5 pl., 1945.

In an investigation into the mineral requirements of plants grown on the poor soils of the Ninety-mile Desert, South Australia, cereals and pasture species grown on a reclaimed area of Laffer sand eight miles south-west of Keith without additional phosphate remained very dwarfed and developed conspicuous symptoms of phosphorus deficiency. The addition of superphosphate allowed vigorous growth, 2 cwt. per acre giving maximum yields. The yield of Algerian oats was greatly increased by a zinc sulphate dressing, lucerne responded to copper sulphate, and the yield and seed production of subterranean clover [*Trifolium subterraneum*] were improved by the addition of zinc sulphate and copper sulphate together. Oats grown with liberal applications of superphosphate alone continued to show

phosphorus deficiency discoloration; zinc sulphate reduced this symptom, but more so at low than at high phosphate levels. The symptoms were not improved by nitrogen, potassium, or copper.

HOPKINS (D. P.). **Chemicals, humus, and the soil.**—278 pp., 5 pl., London, Faber & Faber Ltd., 1945. 12*s*. 6*d*.

In Chapter XIII (pp. 200–219) of this manual, described as 'a simple presentation of contemporary knowledge and opinions about fertilizers, manures, and soil fertility', the author sums up and discusses the arguments for and against the theory that the application of chemical fertilizers impairs the resistance of plants to insect pests, fungal pathogens, and viruses and gradually leads to epidemic ill health [cf. *R.A.M.*, xxv, p. 231]. He concludes that there is no evidence that the incidence of such troubles is increased by the use of chemical nutrients; on the contrary, the treatment in question appears to enhance resistance to some diseases.

É falsa a notícia do aparecimento do 'carvão' nos Canaviais de São Paulo. [The notice of the appearance of 'smut' in the Cane fields of São Paulo is erroneous.] —*Biológico*, xii, 3, pp. 71–72, 1946.

A recent notice in one of the São Paulo daily papers regarding the alleged appearance in the sugar-cane plantations of the State of the dreaded smut (*Ustilago sacchari*) [*U. scitaminea*] was found to rest on confusion between the symptoms of that disease and the presence of a sooty mould.

ARRUDA (S. C.). **As doenças da Cana de Açúcar no Estado de São Paulo. III. Doenças de importância secundária.** [Sugar-Cane diseases in the State of São Paulo. III. Diseases of secondary importance.]—*Biológico*, xii, 3, pp. 63–69, 2 pl., 1946.

Sugar-cane diseases of minor importance in São Paulo, Brazil [cf. *R.A.M.*, xxv, p. 279], include 'iliau' (*Gnomonia iliau*) [*R.A.M.*, ix, p. 807], red rot (*Physalospora tucumanensis*), pineapple rot (*Ceratostomella paradoxa*), and leaf sheath rot (*Cytospora sacchari*), involving the stems and leaf sheaths; the foliicolous brown spot (*Cercospora longipes*), ring spot (*Leptosphaeria sacchari*), brown stripe (*Helminthosporium stenospilum*) [*Cochliobolus stenospilus*], red stripe (*Phytomonas* [*Xanthomonas*] *rubrilineans*), and 'pokkah boeng' (*Fusarium moniliforme*) [*Gibberella fujikuroi*]; and the root-rot complex, associated with *Pythium arrhenomanes*, *Marasmius sacchari*, *Himantia stellifera*, and *Rhizoctonia* [*Corticium*] *solani*.

LANGERON (M.). **Précis de mycologie.** [A compendium of mycology.]—674 pp., 393 figs., Paris, Masson et Cie, 1945. Fr. 450.

The kingdom of living fungi is presented as a background for the student of mycology in general, and of medical mycology in particular. The scene is dominated by the major fact of the extreme polymorphism displayed by all fungi, of which a special manifestation is the morphological reduction suffered by fungi while *in statu parasitico*; and added to this are the unique features of the diplophase and of tetrapolar sexuality displayed by certain fungi. Two laws enunciated by the author concern, firstly, the convergence of morphological characters shown by fungi of diverse affinities, but which live in similar habitats; and, secondly, the mutual reaction of the substratum on the fungus, and conversely of the fungus on its substratum. Five classes of fungi are admitted: Archimycetes, Phycomycetes, Ascomycetes, Basidiomycetes, and Adelomycetes or Fungi Imperfecti.

The chapter on the thallus introduces the student to true mycelium, pseudomycelium, granulomata, sclerotia, bulbils, the propagads of *Omphalia flavida*, with the

aggregation of mycelium both subterranean and aerial into both vegetative and conidial synnemata; and also into sexual stromata and asexual ones, viz., sporodochia, acervuli, pionnotes, and the various types of pycnidia. Next come the organs of fixation; stolons and appressoria, haustoria, the hyphopodia of ectoparasites, and the prehensile organs of the nematode fungi.

The chapter on spores first reviews the sexual types, oospores, zygospores, ascopores, and basidiospores (20 pp.) and then the asexual spores (60 pp.). In the latter the author follows Vuillemin's original classification into thallospores, which are non-caducous and formed from pre-existing portions of the thallus, and conidia, which are caducous and arise *de novo*. Under the former are included arthrospores, blastospores, dictyospores, chlamydospores, and aleuriospores: under the latter conidia on undifferentiated conidiophores (Sporotrichées), those on differentiated conidiophores (Sporophorées), and those on special structures, the phialospores. He also accepts further differentiations, such as myxospores (slime spores) and xerospores (dry spores), macroconidia and microconidia, and a number of special types. A longer chapter deals with liberation of all these different spores from their supports, and with their dispersal after liberation; all groups from the Phycomycetes to the Adelomycetes are considered in detail.

Other chapters deal, respectively, with the flow of the cytoplasm, with hyphal fusions, with the fungi of significance in medical mycology, and with sexuality in the fungi. There is a full chapter on laboratory technique for the examination of living material, and of fixed and stained material, and for making and maintaining pure cultures.

The book closes with a brief account of the classification which the author himself finds most helpful. For this purpose he is proposing no new orders, families, genera, or species, and only a single terminological neologism, simblospore to replace zoospore. He thinks that current science is better served in suppressing one old genus or one old species than in proposing a hundred new ones.

TRINCHIERI (G.). **Notes for the history of mycology. A copy of the Sylloge Fungorum with corrections, additions, annotations and other details appended by the author.**—*Int. Bull. Pl. Prot.*, xix, 7–8, pp. 49M–72M, 1945.

Selections are given from a large number of important notes in Saccardo's handwriting made in the first twenty-two volumes of the Sylloge and the Addimenta ad volumina I–IV which were purchased in 1925 in the original issue (Padua, 1882–1913) for the library of the International Institute of Agriculture, Rome.

CUNNINGHAM (G. H.). **Additions to the smut fungi of New Zealand, I.**—*Trans. roy. Soc. N.Z.*, lxxv, 3, pp. 334–339, 1945.

Ten additional species of smuts (one new) have been collected in New Zealand since the publication of the author's previous paper on this group [*Trans. N.Z. Inst.*, lxi, pp. 402–418, 1930], bringing the total for the Dominion to 40, together with four new hosts [see next abstracts]. Among the important additions not already noted from other sources may be mentioned *Sphacelotheca cordobensis* on *Panicum miliaceum*; *Sorosporium reilianum* [*Sphacelotheca reiliana*] on maize, the first record of any smut on maize in the Dominion; and *Urocystis agropyri* on *Festuca arundinacea*, probably the same as flag smut (*U. tritici*) of wheat.

CUNNINGHAM (G. H.). **Keys to genera and species of New Zealand smut fungi.**—*Trans. roy. Soc. N.Z.*, lxxv, 3, pp. 340–346, 1945.

Keys are supplied to the nine genera and 40 species of smuts so far recorded from New Zealand [see preceding and next abstracts], together with an alphabetical list of hosts.

Cunningham (G. H.). **A revision of the New Zealand species of Farysia.**—*Trans. roy. Soc. N.Z.*, lxxv, 3, pp. 328–333, 1 fig., 1945.

Revised diagnoses are given of five species of *Farysia* occurring in New Zealand (four on *Carex* and one on *Gahnia* spp.), together with a key [see preceding abstracts].

Cunningham (G. H.). **Additions to the rust fungi of New Zealand, I.**—*Trans. roy. Soc. N.Z.*, lxxv, 3, pp. 324–327, 1945.

Four additional species of rusts (including a new one) collected since the publication of 'The rust fungi of New Zealand' (1931) [*R.A.M.*, xi, p. 263] bring the total for the Dominion to 150. They include *Puccinia rhei-undulati* [ibid., xiv, p. 719] on rhubarb, which is spreading slowly through the Dominion. Eight additional hosts are also listed.

Christensen (C. M.). **Keys to the common fleshy fungi.**—45 pp., 8 pl., 69 figs., Minneapolis, Burgess Publishing Company, 1946. $1.50. [Mimeoprinted.]

These illustrated keys to nearly 250 species of common gilled fungi and over 100 species of other fleshy fungi are intended for beginners and designed primarily for self-teaching students. Technical terms are avoided as much as possible, and most of the characters used to determine the larger groups and genera are illustrated by plain explanatory diagrams. No microscopic features are described. Preliminary versions of the keys have already been in use for ten years, and have proved satisfactory for the common larger fungi found in the eastern half of the United States and southern Canada.

Greene (H. C.). **Notes on Wisconsin parasitic fungi. V & VI.**—*Trans. Wis. Acad. Sci. Arts Lett.*, xxxvi, pp. 225–268, 1944. [Received May, 1946.]

The following records occur in these two further instalments of the author's annotated list of Wisconsin parasitic fungi [*R.A.M.*, xxiv, p. 340; cf. also ibid., xxii, p. 374]: *Coniothyrium insitivum* Sacc. on barberry, *Ramularia multiplex* Peck on *Vaccinium macrocarpon*, *Cladosporium* sp. on the aecidial cups of *Tranzschelia* [*Puccinia*] *pruni-spinosae*, *Phoma moricola* Sacc. on mulberry (*Morus rubra*), *Septoria pentstemonis* Ell. & Ev. on *Pentstemon digitalis*, *Melasmia hypophylla* (B. & Rav.) Sacc. on *Gleditschia triacanthos*, *Cryptosporella anomala* on *Corylus americana* [ibid., xiii, p. 208], *Cercospora sequoiae* var. *juniperi* Ell. & Ev. on *Juniperus communis* var. *depressa*, *Helminthosporium sativum* on *Agropyron repens*, and *C. cannabis* (Hara) Chupp n. comb. (*Cercosporina cannabis* Hara) on hemp.

Bitancourt (A. A.). **Novas espécies sul-americanas do género Elsinöe.** [New South American species of the genus *Elsinoe.*]—*Arq. Inst. biol., S. Paulo*, xvi, 3, pp. 19–25, 1945. [English summary.]

Of the four species listed, *Elsinoe bertholletiae* n. sp., the agent of a leaf spot of Pará chestnut or Brazil nut (*Bertholletia excelsa*), in Amazonas, Brazil, and believed to be the first recorded on this host, is characterized by globose or oblong asci, 25 to 35 by 18 to 30 μ, occupied by up to eight hyaline ascospores with three to four transverse and one or more longitudinal septa, 14 to 22 by 6 to 9 μ. The paliform, dark-coloured, densely fasciculate conidiophores of the imperfect (*Sphaceloma*) state measure 12 to 20 by 3 to 4 μ, and are sometimes provided with one or two transverse septa. Conidia were not observed. The scattered, rarely confluent lesions produced by the fungus on both leaf surfaces are round, irregular, or angular (when delimited by the secondary veins), and are of two kinds: up to 1 mm. in width, dark, with a narrow, pecan-brown, raised margin, and 1 to 4 mm. in width, with a white centre, the superficial tissue either disintegrated and traversed by

radial fissures or perforated and surrounded by a raised margin. The mesophyll assumes a mineral-red to mars-violet tinge over a radius of 5 mm. round the lesions.

Losa España (D. M.). **Aportaciones a la flora de micromicetos del Pirineo Español.** [Contributions to the Micromycete flora of the Spanish Pyrenees.]—*An. Jard. bot. Madr.*, v, pp. 79–126, 24 figs., 1945.

Included in this annotated list of fungi in the Spanish Pyrenees [cf. *R.A.M.*, xxiv, p. 475], collected in 1943 and 1944 in connexion with the investigation of the local flora by the Station of Pyrenean Studies, are *Polythrincium* [*Cymadothea*] *trifolii* on clover, *Septoria saponariae* on *Saponaria officinalis*, *Uromyces fabae* on *Vicia sepium* [ibid., xv, p. 529], *Puccinia menthae* on *Mentha longifolia* [ibid., xx, p. 495], *Melampsora allii-populina* on aspen (*Populus tremula*) [ibid., xv, p. 529], *Phragmidium rubi-idaei* on raspberry, and *Cronartium flaccidum* [ibid., xxii, p. 53] on *Pedicularis comosa.*

Alcalde (Maria B.). **Datos micologicos.** [Mycological data.]—*An. Jard. bot. Madr.*, v, pp. 143–160, 9 figs., 1945.

Eight of the 72 species of fungi from various parts of Spain comprised in this annotated list are new to science, while others have not hitherto been recognized among the mycoflora of the country or are of geographical interest. Mention may be made of *Pleospora media* f. *hortensiae* n. f. on *Hydrangea hortensis*, *Sphaerella verrucosa* n. sp. on ivy (*Hedera helix*), and *Pyrenochaeta helicina* n. sp. on the same host (both on living leaves).

Snyder (W. C.) & Hansen (H. N.). **The species concept in Fusarium with reference to Discolor and other sections.**—*Amer. J. Bot.*, xxxii, 10, pp. 657–666, 1945.

Continuing their revision of species of *Fusarium* [*R.A.M.*, xxi, p. 223] the writers consider that all species, varieties, and forms of the sections *Roseum* [ibid., xxiii, p. 410], *Arthrosporiella*, *Gibbosum*, and *Discolor* should be reduced to one species, *F. roseum* Link, with one form, f. *cerealis* (Cooke) n. comb. for the strains parasitic on cereals. For the perfect state they propose *Gibberella* '*roseum*' (Link) n. comb. with the synonym (among others) *G. zeae* (Schw.) Petch, and the form *G. roseum* f. *cerealis* (Cooke) n. comb. The reasons given are that the morphological features which have been used in the classification of these sections, viz., the production and position of chlamydospores, the production and colour of sclerotia, the formation of sporodochia, the colour of the mycelium and the stromata, have been shown by these and other authors as too variable and undependable to be used as distinguishing features. Similarly, conidial shape, colour and septation, foot-cell development and wall thickness are often inconstant and are considered too difficult or unsuitable as criteria. Culture mutation causes further difficulties. On the other hand, some of the species, although not the usual pathogens of cereals, can be made to show pathogenicity in tests, the symptoms then produced being very similar, and moreover, they are often closely associated with root rots. All members of the section *Lateritium* are reduced to *F. lateritium* Nees emend., with the perfect state *G.* '*lateritium*' (Nees.) n. comb. Similarly, the members of other sections are reduced, the conidial features on which the classification has been based having been shown to be unsatisfactory. All members of the section *Liseola* are referred to *F. moniliforme* Sheld. emend., with the perfect state, *G. moniliformis* (Sheld.) Winel. emend. The form species of the section *Sporotrichiella* is *F. tricinctum*, the pathogen on carnations being *F. tricinctum* f. *poae* (Pk) n. comb. The variation of *F. nivale* has been found wide enough to include all the species of the section *Arachnites* with the perfect state as *Calonectria* '*nivale*', the cereal pathogens being *F. nivale* f. *graminicola* (Berk. & Br.) n. comb. *F. episphaeria* (Tode) n. comb. with the Ascomycetous

species *Nectria episphaeria* and one physiologic form f. *coccophila* (Desm.) n. comb. embraces all the types in the sections *Eupionnotes* and *Macroconia*. Although the members of the sections *Submicrocera* and *Pseudomicrocera* were not studied, on the basis of descriptions they are merged into *F. ciliatum* with the one perfect stage *Calonectria* '*ciliatum*' n. comb., both listed as doubtful species. The one species *F. argillaceum* in the section *Ventricosum* is regarded as synonymous with *F. solani*.

The writers admit that physiologic host specialization has not been tested or proved for many *Fusarium* pathogens. When it has, additional formae will have to be established.

Sansome (E. R.). **Maintenance of heterozygosity in a homothallic species of the Neurospora tetrasperma type.**—*Nature, Lond.*, clvii, 3989, pp. 484–485, 2 figs., 1946.

The author demonstrates diagrammatically how in *Neurospora tetrasperma* the inclusion in one ascospore of two nuclei of different types maintains the heterozygosity of characters other than those producing bisexuality. Absence of crossing-over will lead to the segregation of these factors in the first division, resulting in spores which are all alike in one ascus, whereas crossing-over will give segregation in the second division and spores of two types in one ascus. Therefore by culturing spores it is possible to determine where segregation has occurred. The results of Dodge, Schmitt, and Appel are used to illustrate this.

Norris (D. O.). **Differential isolation of Chaetomium spp. from mixed populations by hypochlorite solution.**—*J. Coun. sci. industr. Res. Aust.*, xviii, 4, pp. 310–313, 2 pl., 1945.

The author's studies showed that *Chaetomium* spores are highly resistant to calcium hypochlorite solution prepared by J. K. Wilson's method and containing about 2 per cent. chlorine. Large numbers of spores of *C. globosum* survived immersion for 15 minutes, while an occasional spore survived for two hours. As this solution is a very effective sterilizing agent against other fungi and bacteria, its use in culture plates enables *C.* spp. to be isolated at will from mixed populations.

Zuck (R. K.). **Isolates intermediate between Stachybotrys and Memnoniella.**—*Mycologia*, xxxviii, 1, pp. 69–76, 2 figs., 1946.

The author considers *Stachybotrys* and *Memnoniella* [*R.A.M.*, xxiv, p. 389] to be valid genera, though he found isolates intermediate between the two, having both slimy heads and chains of spores. Other cultures of *M. echinata* remained stable with catenulate spores, including one which was at first misidentified as *S. papyrogena*. No culture of *S. subsimplex* was obtained from cloth exposed to soil contacts unless this designation may be applied to the intermediate phase found.

Agatov (P.). Влияние иода на активность вируса табачной мозаики. [The influence of iodine on the activity of the Tobacco mosaic virus.]—*C. R. Acad. Sci. U.R.S.S.*, N.S., xlix, 7, pp. 542–544, 1945.

Experimental evidence is adduced to show that inactivation of the tobacco-mosaic virus protein by iodine is negligible at P_H 5·5 to 6·6, but complete at 4·5 and at 8·0. Inactivation on the alkali side is attributed to the oxidizing effect of the iodine and that on the acid side to assimilation with the protein.

Wei (C. T.) & Cheo (P. C.). **Diseases of Tomato in the vicinity of Chengtu.**—*Chin. J. agric. Sci.*, i, 4, pp. 288–291, 1944. [Chinese, with English summary. Received June, 1946.]

Notes are given on the following diseases, arranged in order of decreasing importance, affecting the tomato crop in the vicinity of Chengtu, China: common

mosaic [tobacco mosaic virus], streak [a strain of the foregoing], fern-leaf [cucumber mosaic virus], spotted wilt virus, bunchy top virus, yellow mosaic [a strain of the tobacco mosaic virus], sour rot (*Oospora lactis parasitica*), anthracnose (*Colletotrichum phomoides*, *Gloeosporium fructigenum* [*Glomerella fructigena*], and *Vermicularia* [*C.*] *capsici*), leaf spot and stem canker (*Septoria lycopersici*), leaf spots and fruit rots (*Phoma destructiva* and *Ascochyta lycopersici*), bottom rot, fruit rot (*Alternaria tenuis*), early blight (*A. solani*), fruit rot (*Discosporella phaeochlorina* Wei and Cheo), soft rot (*Erwinia carotovora*), soil rot (*Rhizoctonia* [*Corticium solani*), sun scald, *Fusarium* fruit rot, cottony leak (*Pythium aphanidermatum*), fruit rot (*Phytophthora parasitica*), sclerotial disease (*Sclerotium rolfsii*), dry rot (*Phomopsis* [*vexans*]), and fruit rot (*Nematospora lycopersici*).

The tomato strain of *G. fructigena* was shown by cross-inoculation experiments to be identical with the agent of apple and pear bitter rot, while the same form of *Colletotrichum capsici* is responsible for the infection of tomato, eggplant, and [chilli] pepper.

Control measures are indicated.

MILLER (H. W.). **A new disease of Russian olive in the Pacific Northwest.**—*J. For.*, xliv, 2, pp. 118–120, 1946.

Russian olive (*Elaeagnus angustifolia*), widely grown for soil and water conservation purposes in the Pacific Northwest, has been attacked by a hitherto-unreported disease of obscure etiology. The first and most typical feature is the arrested development of the buds, which remain in a partially opened condition and gradually desiccate. The following year the affected portion of the branch is dead, and the same symptom occurs progressively down the stem until the root collar is reached and the tree killed. Small, brown, necrotic areas are formed just outside the phloem, usually on the under side of diseased stems. In a typical planting in Washington of 194 trees, laid down in 1938, only one was still surviving in 1943, and that was severely diseased.

MCKINNEY (H. H.). **Soil factors in relation to incidence and symptom-expression of virus diseases.**—*Soil Sci.*, lxi, 1, pp. 93–100, 1946.

A comprehensive survey is made of the principal literature covering disease incidence in the wheat mosaic rosette and yellow mosaic (*Marmor tritici*) [*R.A.M.*, iii, p. 84; vii, p. 232; xxiv, p. 136], tobacco mosaic (*M. tabaci*) [ibid., ix, p. 207; xiii, p. 729], tomato mosaic and tomato streak [ibid., vii, p. 481], and big vein of lettuce [ibid., xiv, p. 283; xxi, p. 512; xxiii, p. 259; xxiv, p. 135] virus diseases with special reference to their overseasoning in the soil and to the influence of soil factors on the activity of viruses in the plant and on plant reactions. The tobacco and tomato mosaic viruses appear to reinfect from plant debris and are eliminated by the removal or ploughing-in of this or by alternate cropping; the wheat mosaics and lettuce viruses are eliminated only by soil sterilization.

Among the various aspects discussed are the confusion in diagnosis of symptoms arising from disturbances of the chlorophyll status plants due to mineral deficiencies; the tendency for high nitrogen status of the soil to favour mosaic infection, but to obscure the symptoms causing yellow mosaics to resemble light green mosaics and almost to obliterate the latter; the use of nitrogen fertilizers as a means of confirming the view that succulent plants are more susceptible to viruses; and the effect of fertilizers on the incidence and severity of virus diseases, in particular the effect of nitrogen applications from minimum to maximum on tobacco mosaics is reviewed in relation to (1) number of lesions and incubation time, with and without the additions of either or both phosphorus or potash, (2) protein synthesis and virus content, and (3) inoculations of young and old leaves and subsequent spread of the virus are among the soil factors reviewed.

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Hansen (H. P.). **Undersøgelser og Iagttagelser over Tobaksviroser i Danmark.** [Investigations and observations on Tobacco viroses in Denmark.]—*Tidsskr. Planteavl*, 1, 2, pp. 191–298, 17 figs., 1946. [English summary.]

The diseases observed in these comprehensive laboratory and field studies on tobacco viruses in Denmark [*R.A.M.*, xxv, p. 14] fell into three groups, characterized mainly by (A) mosaic symptoms, (B) severe foliar distortion, and (C) necrosis. Representative of (A) were ordinary tobacco mosaic (*Lycopersicum* virus 1 [a strain of tobacco mosaic virus], occasionally *Nicotiana* virus 1 [tobacco mosaic virus]), net mosaic or vein-clearing, usually caused either by *Solanum* virus 2 [potato virus Y] or *Cucumis* virus 1 [cucumber mosaic virus]; spot mosaic, also generally due to one or other or the foregoing but sometimes associated with *S.* virus 1 [potato virus X]; ring mosaic (potato virus X); and mottling of diverse origin, e.g., manganese deficiency, genetic constitution, and a disturbed water balance. (B) included band or thread-leaf (tobacco mosaic virus) and crinkle mosaic of two types, (*a*) irregular foliar crinkle and distortion, often accompanied by the dark green blisters of severe mosaic (tobacco mosaic virus), and (*b*) more or less irregularly crinkled leaves, often contracted just behind the tip, with mosaic of varying intensity, with pale patches mostly along the veins (cucumber mosaic virus). Group (C) comprised stripe and curl disease (*N.* virus 5) [? a strain of tobacco streak virus: ibid., xxv, p. 83]; vein and spot necrosis, sometimes associated with a combination of potato viruses X and Y or potato virus X and cucumber mosaic virus; labyrinthic necrosis (probably tobacco streak virus); large, circular masses of necrotic spots on the basal or medium leaves of plants affected by labyrinthic necrosis or in the same field, presumably another manifestation of the *N.* virus 5; ring necrosis (potato virus X); and necroses resulting from adverse environmental factors of various kinds or insect injuries.

The two most serious diseases were tobacco mosaic and the stripe-and-curl form of streak. The former was widespread in all tobacco-growing districts, its incidence in some cases ranging from 25 to 75 per cent. with a resultant loss in value of 50 per cent. The Burley variety appears to be more susceptible to the tobacco mosaic virus in the field than F.U., U., or Havana. Stripe-and-curl disease was very prevalent in Fünen and Jutland, causing up to 100 per cent. infection and material damage to the crops, the leaves of diseased plants being practically worthless. The virus thrives in soil [ibid., xxv, p. 83] with a high moisture content.

The other diseases listed above are in general of minor importance, though they may be locally severe. Those caused by potato virus Y are controllable by the selection of sites for tobacco plantations at a reasonable distance from potato fields. The writer has shown that the dissemination of this virus by aphids from potato to tobacco is governed by the same general rules as those applying to field transmission from potato to potato [ibid., xxv, p. 311]. Similar observations hold good for virus X.

Individual samples of the several viruses from infected plants were subjected to intensive analysis. None of those referred to potato virus Y caused malformation of inoculated tobacco plants. Some of the cucumber mosaic virus samples induced

in tobacco symptoms closely resembling those of potato virus Y, while others also caused foliar distortion.

Of the two viruses causing tobacco mosaic in Denmark *L.* virus 1 induces in tobacco a mosaic, usually with foliar necrosis, but severe distortion is scarcely ever present, whereas with *N.* virus 1 the mosaic, normally non-necrotic, is frequently associated with severe leaf malformation. One strain (4) of *L.* virus 1 caused systemic symptoms in *N. glutinosa.* In *Datura stramonium* both *N.* virus 1 and L. virus 1 induce a systemic, generally lethal disease, with mostly unilateral stem and petiole necrosis. Tomatoes may respond to inoculation with the usual symptoms. The two agents of the tobacco mosaic were shown to be serologically related but not identical. In immunological tests *L.* virus 1 conferred little or no protection against subsequent infection by *N.* virus 1.

Besides these two main types, this group comprised some forms inducing very mild symptoms or none on tobacco. Of these No. 78_2 was latent in tobacco plants except for faint primary symptoms, vein-clearing, and initial slight mottling. The inoculation of *N. glutinosa* with juice from apparently healthy tobacco plants harbouring No. 78_2 resulted in primary local lesions of the ordinary type, while *D. stramonium* succumbed to lethal necrosis as usual. Infection by the masked virus No. 78_2 immunized tobacco plants against subsequent invasion by both the main forms of the tobacco mosaic virus.

All samples of stripe-and-curl-diseased tobacco plants contained the streak virus, with the addition in one only (No. 56) of potato virus X. The symptoms in greenhouse-inoculated plants were different from the usual field type, foliar crinkle being considerably less prominent or quite absent in older plants. Four days to a week after inoculation, the leaves presented a more or less curled appearance and bore necrotic, water-soaked, later desiccated, irregularly concentric lesions along and between the veins. Systemic necroses often developed in the primary leaf veins and petioles two to three weeks after infection, sometimes accompanied by necrotic streaks in the stem which, on the other hand, might not appear for one to two months or were altogether lacking. In many plants stem necrosis was the sole feature of the disease, while in others some of the leaves or a single shoot only were affected, and instances were also observed of the passage of the virus in a latent state through individuals showing no symptoms. True mosaic mottling was never induced by the streak virus, but zonate patterns of almost white lines occasionally developed on one or another leaf. In *N. glutinosa* the symptoms were essentially similar to those of tobacco, but systemic infection was less frequent. *D. stramonium* reacted positively only on the addition of carborundum powder to the inoculum, when dirty yellow blotches and irregular necroses appeared on the foliage after 12 days: in some cases the disease assumed a systemic form in the leaf veins, petioles, and stems, killing the plants within a month of inoculation. No symptoms developed in Up-to-Date potatoes after juice or grafting inoculations, but the young leaves of several shoots of a King Edward plant acting as a stock for a streak-diseased tobacco scion bore a few dark brown, necrotic spots. Juice from the infected leaves, mixed with carborundum, was inoculated into tobacco plants, which within six days developed typical streak symptoms. Contrary to Böning's observations [ibid., x, p. 563], therefore, the tobacco streak virus is definitely capable of infecting potato. The juice of streak-diseased plants was infectious at a dilution of 1 in 100 but not at 1 in 1,000, and after ten minutes' heating at 70° (but not 75°) or 40 days at 15°.

Infection of healthy tobacco plants was obtained with only one sample (No. 9) of the labyrinthic necrosis virus, the admixture of carborundum being necessary to secure proper results. This No. 9 sample is considered to be identical with that of tobacco streak. Ring mosaic, without doubt caused by potato virus X, was detected in a number of fields.

The properties of all the samples isolated are fully summarized in tables and a bibliography of 93 titles is appended.

HICKMAN (C. J.). **Infection of outdoor Tomato crops by Didymella lycopersici.**—*J. Pomol.*, xxii, 1–2, pp. 69–75, 1946.

In the Evesham area from 1941 to 1945 stem and fruit rot of tomato (*Didymella lycopersici*) appeared usually during July. Estimates of percentage losses for the years 1941–4 are given. The possibility that the disease might have its origin in the propagating soil or be seed-borne was experimentally examined. From locally grown seed, such as is widely used by Evesham growers, three groups of pycnidial fungi were isolated, of which one was determined as morphologically and pathogenically identical with cultures of *D. lycopersici*. The relation of seed infection to outbreaks of disease was studied in 1944, when plants were propagated in sterilized soil, one lot of which, (A), was grown from healthy seed mixed with 2 per cent. of seed showing 70 per cent. infection saved from diseased fruits, and the other, (B), from the infected seed only. No signs of *D. lycopersici* were seen during the period of germination. On 1st June 250 plants of each series were field-planted on land not previously cultivated with tomatoes. Following an unusually early appearance of stem rot, a few wilting plants were collected on 14th June. From 21st June to 24th August 63 severely wilted plants were removed from plot A and 85 from B, infection by *D. lycopersici* being confirmed for every plant. The conclusion is drawn that a small number of infected seeds in a sample may have epiphytotic effects where conditions favour the activity of the pathogen.

In experiments in 1943 and 1944 six growers co-operated to raise 100 plants each from the same healthy seed stock under their own conditions of cultivation, which ranged from excellent to bad, the plants being then transferred to land which had not previously borne tomatoes. It was found that no stem rot occurred on plants raised under good cultural conditions in nurseries with no previous record of the disease. Infection occurred in the field among plants raised under poor hygienic conditions in nurseries where the disease had been previously experienced.

In 1943 plants raised in pots of soil from a field that had carried successive heavily infected crops showed no trace of infection in the seedling stage and only infected plants later. In 1944 healthy plants were set out in seven fields that had previously borne diseased crops, but the disease appeared in appreciable amount only in one field, and even then more than half the infections did not develop until late.

These experiments showed clearly that an adequate rotation and healthy propagation will substantially reduce the possibility of early and serious outbreaks of *D. lycopersici* originating in the field.

Whether the fungus survives as mycelium or by pycnidia or, as considered possible by the author, by perithecial spores [*R.A.M.*, xxiv, p. 78], and whether the spores overwinter in cracks on canes, as suggested by Kordes [ibid., xii, p. 663], are questions which have finally to be determined. However, the danger which may arise from contaminated canes was exemplified in one experiment in 1945, when 38 out of 50 plants staked with suspected canes became infected, whereas two similar sets of plants staked with disinfected and new canes showed no infection.

Province of Nova Scotia, Report of the Department of Lands and Forests, 1945.—118 pp., 1 graph, 4 maps, Halifax, N.S., King's Printer, 1946.

The following information of phytopathological interest is presented on pp. 39–47 of this report [cf. *R.A.M.*, xxv, p. 51]. Die-back of yellow birch made rapid progress during the period under review, the most advanced stage of infection being in the Chignecto region of Cumberland County, where most of the trees have been

dead for several years. Data obtained in ground cruises at 24 points in the Province reveal complete mortality in 10 to 15 per cent. of the standing birch (4 in. and upwards in diameter), and 25 per cent. is over half dead. In merchantable-size plantations (8 in. and upwards in diameter) the corresponding figures are 20 and 40 per cent., respectively.

Moist chamber cultures and plate inoculations with material isolated from diseased trees yielded *Dermatea molliuscula* in its imperfect state, *Gelatinosporium fulvum*, *G. betulinum*, *G. magnum*, a *Phomopsis* agreeing with the conidial state of *Diaporthe eres* (apparently identical with the European *D. perniciosa*) [ibid., xiii, p. 270], and two species of *Cryptosporiopsis*, possibly representing the conidial states of *Ocellaria ocellata* and *Pezicula betulae*. The results of inoculations to date denote that well-watered healthy seedlings with strong, uninjured root systems will overcome infection by these organisms.

An investigation of the exposed root systems of five trees in a severely diseased stand in Picton County revealed the presence of rhizomorphs of *Armillaria mellea* in all cases and that of mycelial forms of the fungus in one: rootlet mortality ranged from 29·2 to 100 per cent.

Miller (P. W.). **Current investigations on the control of Walnut blight and Filbert blight by dusting.**—*Rep. Ore. St. hort. Soc.*, [*1945*], pp. 84–85, [? 1946].

In dusting trials against walnut blight [*Xanthomonas juglandis*: *R.A.M.*, xxiii, p. 416; xxv, p. 192] in Oregon in 1945 on Franquette walnuts, copper+lime+sulphur+oil (20—40—10—2), copper hydroxide+sulphur+oil (30—15—2), copper+lime+sulphur (20—40—10), and zinc coposil+sulphur+oil (25—15—2) dusts applied four times at approximately weekly intervals from the early pre-bloom stage reduced infection from 25·4 per cent. in the controls to 2·2, 5·2, 5·4, and 6·5 per cent., respectively. Under the same conditions, Bordeaux mixture (4—2—100) applied in the early and late pre-bloom and early post-bloom stages reduced infection to 2·4 per cent. In a different locality, four weekly applications of a copper+lime+sulphur (20—40—10) dust from early pre-bloom reduced infection from 41 to 2·1 per cent.

For general use a dust composed of 20 per cent. monohydrated copper sulphate, 40 per cent. hydrated lime, 10 per cent. dusting sulphur, 18 per cent. talc, 10 per cent. diatomaceous earth, and 2 per cent. light, highly sulphonated oil is recommended. If filberts [*Corylus avellana*] are planted among the walnuts to be treated, the sulphur should be omitted. In an average west Oregon season, four dust applications should be made at intervals of not over seven days from the early pre-bloom stage. In a very wet season, six applications at intervals of a week may be required.

One year's tests indicated that a copper dust will materially reduce bud and twig blight [*Phytomonas corylina*], one application, for example, of a yellow cuprous oxide+lead arsenate (10—40) dust applied in the middle of July, 1944, reducing it from 3·3 to 0·06 per cent. Further work is necessary; meanwhile a dust composed of 25 per cent. monohydrated copper sulphate+33 per cent. lime+40 per cent. lead arsenate+2 per cent. light, highly sulphonated mineral oil, or, alternatively, one composed of 10 per cent. yellow cuprous oxide+40 per cent. lead arsenate+10 per cent. diatomaceous earth+38 per cent. talc+2 per cent. light mineral oil is recommended for trial.

Bitancourt (A. A.) & Rossetti (Victoria). **As galhas pulverulentas das Lauraceas.** [The powdery galls of the Lauraceae.]—*Biológico*, xii, 3, pp. 55–62, 3 pl., 1946. [English summary.]

Trees of the genera *Nectandra*, *Ocotea*, *Cryptocarya*, and other members of the Lauraceae in neotropical forests are often affected in the spring and summer by

galls attributed by different authors to fungi of various groups, of which the Basidiomycetes appear to be the most appropriate for their accommodation on morphological grounds. The following species have been observed in São Paulo, Brazil, since 1931: *Drepanoconis larviformis* Speg., the agent of chalk-white, powdery galls on the young shoots, stems, leaves, and pistils or young fruits of *N. puberula, N. tweediei, N. nitidula, N.* sp., and (?) *C. mandiocana*; *Clinocodium farinosum* (Henn.) Pat., producing dark brown, powdery excrescences on *N. tweediei* and *N.* sp., and *C.* sp., causing a verrucose foliar gall of *N.* sp.; *Botryoconis saccardoi* H. & P. Syd., forming brown, powdery galls on the stems of an undetermined host; *B. pallida* H. & P. Syd., responsible for the development of whitish, powdery galls on *O. pulchella* fruits; and a hitherto undescribed species producing yellowish, powdery galls on the stems of an unnamed host.

NEILSON-JONES (W.). **Further field observations on fused needle disease of Pines.**—*Emp. For. J.*, xxiv, 2, pp. 235–239, 2 figs., 1945.

The results of the experiments in the Wareham forest [*R.A.M.*, xxi, p. 312] on fused needle disease of pines, continued for a further five years, proved the value of a compost C5, derived from spent hops (phosphorus pentoxide content 2·8 per cent.), alone or in combination with basic slag in preventing the incidence of the disease in and promoting recovery of diseased *Pinus contorta* trees, more than half the trees recovering in five years, whereas in the healthy untreated controls 24 per cent. became affected. While in this test C5 was effective, another compost C1, derived from straw (phosphorus pentoxide content 0·77 per cent.), was not, and it became clear that successful use of composts was dependent on the phosphate level not being a limiting factor, although basic slag alone gave only a transitory improvement. The cost of the above combined treatment is, however, sufficiently high to suggest discarding planting of *P. contorta* and other susceptible species in areas where climatic and edaphic conditions favour the development of the disease.

A photograph is appended of a 12-year-old Scots Pine (*P. sylvestris*) which developed severe symptoms during the 1944–5 season, although this species is generally resistant to fused needle disease in this country.

RENNERFELT (E.). **Om vår nuvarande kunskap om törskatesvampen (Peridermium) och sättet för dess spridning och tillväxt.** [On our present knowledge of the 'resin top' fungus (*Peridermium*) and its mode of dissemination and growth.]—*Svenska Skogsvårdsfören. Tidskr.*, xli, 4, pp. 305–324, 7 figs., 1 map, 1943. [German summary. Received April, 1946.]

Scots pines (*Pinus sylvestris*) in Sweden harbour two blister rusts, the autoecious *Peridermium pini*, and the heteroecious *Cronartium asclepiadeum* (*P. cornui*) [*R.A.M.*, xviii, p. 73] with the teleutospore stage on *Cynanchium vincetoxicum*, *Paeonia* spp., and other plants of minor importance. Most of the inoculations performed in 1942–3 with blister rust collections from the south and south-east of the country gave positive results on *C. vincetoxicum*, indicating that *Cronartium asclepiadeum* predominates in these regions, whereas none of the northern collections infected the alternate host, denoting their identity with *P. pini*. Only one of the numerous experiments on pine was successful.

The rust appears to gain ingress to the trees mainly through the stomata of the needles. Aecidia develop two to three years later and the mycelium proceeds through the branches to the stem. Sections through 11 diseased stems yielded information concerning the age of the wounds and of the pines at the time of infection, the former ranging from 8 to 31 and the latter from 65 to 96 years.

Rennerfelt (E.). **Om Granens rotröta, dess förekomst och utbredning.** [The occurrence and distribution of Spruce butt rot.]—*Svenska Skogvårdsfören. Tidskr.*, xliii, 4, pp. 316–334, 4 figs., 2 diags., 1 map, 1945. [English summary.]

Fomes annosus is the most destructive of the fungi concerned in the etiology of butt rot of spruce [*R.A.M.*, xxv, p. 193] in Swedish forests, where the disease is responsible for annual heavy losses and requires intensive study from the silvicultural, edaphic, and mycological angles.

The fungus occurs principally as a saprophyte on spruces approaching the felling age, the dead roots on the under side of the stubs probably constituting the main channels of ingress, but on sandy soils in some districts, e.g., Scania, Blekinge, and Halland, it assumes a parasitic form both on spruce and pine in the younger age-groups. *F. annosus* has very rarely been observed on larch.

The geographical distribution of the pathogen was studied by means of malt agar cultures from increment cores obtained by sterile drilling. It was found to be widespread in the southern and central regions and over extensive areas in the north, exclusive of the granite rock formations in the last-named. The incidence of the disease was investigated by the drilling of all spruces over 10 cm. in diameter at breast height on small experimental plots. In severe cases 50 to 80 per cent. of the trunks might be involved, especially on previously cultivated sites or soils with a high lime content, though heavy damage was also recorded on sandy and moraine soils. Spruce stands succeeding beech or mixed with other trees were generally comparatively healthy.

There is no immediate prospect of a direct campaign against the butt rot caused by *F. annosus*. Where the damage warrants such a measure, spruce should be replaced by broad-leaved trees, such as oak, beech, and birch, which are very seldom attacked, or resistant conifers, e.g., larch, European silver fir [*Abies alba*], and (generally) Scots pine [*Pinus sylvestris*].

Treschow (C.). **Undersøgelser over Brintjonkoncentrationens Indflydelse paa Vaeksten af Svampen Polyporus annosus.** [Studies on the influence of the hydrogen-ion concentration on the growth of the fungus *Polyporus annosus*.] —*Forstl. Forsøgsv. Danm.*, xv, pp. 17–32, 1 fig., 1943. [German summary. Received July, 1946.]

Following up previous studies by Swedish and Danish workers, the author found that the influence of the hydrogen-ion concentration on the growth of *Polyporus* [*Fomes*] *annosus* isolated from spruce [see preceding and next abstracts] depends on the nature of the substratum [*R.A.M.*, xii, p. 543]. Thus, in a liquid medium, 3 per cent. malt extract, growth reached a peak at P_H 4 to 4·4 and no development took place at above P_H 6 or below P_H 3. However, on filter paper in the same medium, i.e., under conditions simulating those afforded by a solid substratum, there was no variation in the growth of the fungus within a range of P_H 3 to 7. In tests with sterilized forest humus equally profuse growth was made on the acid litter of spruces (P_H 4·3) and beech mould (P_H 6·3), but the fungus was unable to develop in pure mineral soils. When the hydrogen-ion concentration of sterile forest humus was varied by the admixture of lime in amounts ranging from 2 to 20 gm. per 50 gm. soil no difference in the growth of the fungus was detected in the several flasks.

Wagener (W. W.) & Cave (M. S.). **Pine killing by the root fungus, Fomes annosus, in California.**—*J. For.*, xliv, 1, pp. 47–54, 2 figs., 1946.

Fomes annosus has been found to be a primary agent of mortality among Jeffrey and ponderosa pines (*Pinus jeffreyi* and *P. ponderosa*) of all ages in the easterly section of the California pine region, where sugar and Coulter pines (*P. lambertiana*

and *P. coulteri*) may also be killed. A re-examination of the cultures isolated by Olson from trees in the Lassen National Forest and described by him as a new species, *Cunninghamella meineckella* [*R.A.M.*, xxi, p. 233], confirmed the suspected identity of the latter with *F. annosus*, which was again observed in 1941 in the Cleveland National Forest causing heavy loss, in conjunction with *Armillaria mellea*, in *P. jeffreyi* stands. The fungus, a source of serious damage to conifers in Europe [see preceding abstracts], has not hitherto been regarded as a major pathogen in the United States. Recent evidence indicates that it is also much more prevalent than formerly supposed on white and Californian red firs (*Abies concolor* and *A. magnifica*), causing butt and root rot.

Infection spreads from an initial focus, such as a stump or snag, to surrounding trees through contact between overlapping root systems, forming a roughly circular opening in stands on level ground. The disease is almost wholly confined to light sandy soils (P_H 5·7 to 6·7) in the drier areas of the pine belt. Destruction by *F. annosus* does not extend far above ground-level. Trees enfeebled by the root rot are commonly invaded by bark beetles and then resemble those killed by the primary action of these pests. Heavy infiltrations of resin are characteristic of roots initially attacked by the fungus, which rarely produces sporophores on infected pines. After the death of the trees the organism persists in the roots and butt as an agent of decay.

White Pine blister rust control in California and Oregon.—*J. For.*, xliii, 11, p. 831, 1945.

In this summary of an 18-page mimeographed report with the same title issued in January, 1945, the progress of white pine blister rust [*Cronartium ribicola*] in western North America since its introduction is briefly traced [*R.A.M.*, xxiii, p. 122]. The rust has advanced steadily southwards and is now established in Washington, Oregon, and California, the southernmost known infected areas of the sugar pine [*Pinus lambertiana*] forests in the last-named State being in the Eldorado National Forest, some 240 miles south of the Oregon line, where the disease was observed on currants and gooseberries in 1944 [ibid., xxiv, p. 296]. Within the borders of California and Oregon falls the entire range of the very valuable sugar pine, 2,500,000 acres of which have been included in the blister rust control zone.

Hansbrough (J. R.). **The significance of black line stain in Yellow Birch propeller lumber.**—*Spec. Release Dir. For. Path. U.S. Dep. Agric.* 23, 4 pp., 1945. [Mimeographed.]

During the past few years, yellow birch [*Betula lutea*] used for aeroplane propellers in the United States has shown the presence of a stain localized in the vessels and producing narrow, black, roughly parallel lines [cf. *R.A.M.*, xxiv, p. 346]. The condition is commonest in boards exposed to the weather during air-seasoning, and is primarily a sapwood stain, though occasionally found in the heartwood. Microscopic examination showed that the stain is due to one or more (so far unidentified) fungi that penetrate the vessels and grow extensively in them, but seldom pass into the other wood elements, and produce narrow, hair-like, black or bluish-black streaks. The colour is imparted by the mycelium and does not result from staining of the wood. The prevalence of the stain appears to be due to unsatisfactory transit and storage conditions.

Experimental evidence demonstrated that the difference in toughness and specific gravity between affected and normal wood was insignificant. Dipping in dowicide H or G (6 or 7 lb. per 100 gals.), santobrite (7 lb. per 100 gals.), permatox 10S (10 lb. per 100 gals.), or lignasan (2 lb. per 100 gals.) within 24 hours of sawing should give adequate control.

JACQUIOT (C.). **Contrôle de l'efficacité des fongicides utilisés pour l'imprégnation des bois. Étude critique de la technique standard anglaise et de la norme allemande DIN DVM 2176. Principes pour l'établissement d'une norme française.** [Examination of the efficacy of the fungicides utilized for timber preservation. Critical study of the English standard technique and of the German standard DIN DVM 2176. Principles for the establishment of a French standard.]—*Ann. Éc. Eaux For. Nancy,* viii, 2, pp. 187–206, 1942. [Received April, 1946.]

With a view to the establishment of a standard French technique for the testing of timber preservatives, the writer made a comparative study of the official English [*R.A.M.*, xviii, p. 829] and German methods [ibid., xxi, p. 277] for determining the relative efficacy of these products [see next abstract]. Both procedures are open to a number of criticisms both in principle and in the details of their application, and in the proposed French standard [cf. ibid., xvi, p. 291] it is hoped to avoid these drawbacks. The fungi to be included in the tests should comprise, on the one hand, such ubiquitous and refractory species as *Coriolus* [*Polystictus*] *versicolor* and *Coniophora cerebella* [*C. puteana*], and on the other the particular organisms against which protection is sought, e.g., for pine posts, *Lenzites abietina* and *Xanthocrous* [*Fomes*] *pini*; for pine frame-work and joinery, *Gyrophana* [*Merulius*] *lacrymans*; for oak posts, sleepers, frame-work, and joinery, *L. quercina*; and for beech sleepers, *L. degener* Kalchbr. The final determinations should be based on tests of the inhibitory and toxic properties of the various preservatives, as well as of the resistance of the treated wood to a series of leachings. In preliminary tests of nitrophenols, a pyroligneous extract, and complex products such as injectauzol with a realgar base, only the first-named gave any promise as possible substitutes for creosote, and they were about twice as effective against *L. degener* as against *P. versicolor* (the only two fungi used).

LUTZ (L.). **La méthode 'wood-block' pour la détermination du pouvoir toxique des antiseptiques utilisés pour la préservation des bois d'œuvre. Ses incertitudes.** [The 'wood-block' method for the toximetric determination of the antiseptics utilized for timber preservation. Its uncertainties.]—*Rev. int. Bois,* xiii, 103, pp. 1–2, 1946.

The writer's objections to the German wood-block method for the toximetric determination of timber preservatives are expounded, based on its inadequacy and unreliability, and a further plea made for international co-operation in the development of a standard technique for this purpose [see preceding abstract].

RISCHEN (H. W. L.). **Aperçu des antiseptiques pour la préservation des bois utilisés dans les différents pays européens avant et pendant la guerre.** [A glance at the antiseptics for wood preservation utilized in the different European countries before and during the war.]—*Rev. int. Bois,* xiii, 103, pp. 3–8, 1946.

Before the war of 1939–45, creosote was the most widely used preservative in European countries for the treatment of railway sleepers, telegraph poles, etc., but during the period of hostilities substitutes were largely used. A questionnaire on the subject of these changes addressed by the International Office of Studies on Wood Preservation to the railway and postal authorities in 12 countries elicited 13 replies containing information on the practices adopted, a summary of which is given in this report.

MOORE (G. E.). **Soil as a culture medium for toximetric tests of wood preservatives.** —*Mimeogr. For. Prod. Lab. Can.* 102, 3 pp., 1944. [Received June, 1946.]

A detailed description is given of the method of using soil as a culture medium in toximetric tests of wood preservatives [*R.A.M.*, xix, p. 127]. To 300 gm. oven-

dry soil in a 16-oz. straight-sided jar with a screw cap distilled water is added to bring the water content up to 25 per cent. of the dry weight of the soil. Soil and water are stirred. If non-volatile preservatives are being tested, treated test blocks of known oven-dry weight may now be placed in the soil, otherwise this is done after the soil has been sterilized and cooled. The jars of soil, with or without the blocks, are next sterilized in an autoclave and after removal, the loose caps are screwed on tightly. If the test blocks are already in the soil, each jar is inoculated, when cool, with a standard culture of a wood-destroying fungus, the inoculum being placed on a slightly emergent corner of the block or on the soil close to it, and incubated at 81° F. Four months later, the blocks are removed, oven-dried, and weighed. Parallel control tests are carried out on untreated blocks.

Colleary (M. J.). **Treated and untreated timbers: completed service tests to date and notes regarding tests in progress.**—*Mimeogr. For. Prod. Lab. Can.* 105, 29 pp., 1945.

This report presents in tabular form the average life of timber components and structural units of several species of Canadian woods, untreated, and submitted to various treatments compiled from 157 service records so far completed in the Forest Products Laboratories of the Dominion Forest Service, Canada. Details of these tests are shown individually by Provinces in another table, which gives the salient facts of the full service life of each separate group of timbers removed from service. The present collection of service records is very incomplete and further tests require to be inaugurated.

Christensen (G. N.). **Notes on a method for the study of diffusion of salts through green timber.**—*J. Coun. sci. industr. Res. Aust.*, xviii, 4, pp. 407–411, 3 figs., 1945.

As many Australian commercial timbers are refractory to penetration of preservatives by pressure, the method of penetration of green wood by diffusion is often used. The usual way of securing quantitative estimation of penetration has been to treat blocks of wood with solutions for given periods, then sectioning and analysing the samples. To obviate the disadvantages of this practice, a technique has now been devised to study diffusion through a wooden disk interposed as a 'membrane' in a diffusion cell.

Two glass bottles $2 \times 2 \times 2\frac{1}{2}$ in., of about 110 ml. capacity each, have one vertical face ground out, so that when the two openings are placed together the bottles form the two compartments of the diffusion cell. The specimen 'membrane' or disk is the same shape as the aperture, but larger. It is held in place by two rubber gaskets, the whole cell being held firmly by screw clamps and metal plates insulated from the glass by rubber pads.

The disk is coated round the periphery and for a $\frac{1}{4}$-in. margin round both faces with a double application of lacquer to make it watertight. The ground-glass faces of the cell are smeared with petroleum jelly. Both compartments should be filled with 100 ml. distilled water, and left for 24 hours at the temperature of the experiment to leach the water-soluble constituents in the disk. For the test one compartment is filled with distilled water and the other with a solution of the treating salt, both at the appropriate temperature. Both compartments are stoppered, and a short, open capillary is inserted in each stopper. Every 24 hours or so, the distilled water is removed for analysis. The compartment is refilled with 100 ml. distilled water at the required temperature and left undisturbed for a further period. For very accurate work, some form of agitation of the solutions is necessary, e.g., a rocking or rotating tray. It is also desirable to correct the concentration of the salt solution periodically.

Berry (A. G. V.) & Cater (J. C.). **Interim report on trials of copper naphthenates and mercuric naphthenates as wood preservatives.**—*Emp. For. J.*, xxiv, 2, pp. 233–235, 1945.

This report describes the condition of wood specimens three to six years after being given treatments previously described (*Emp. For. J.*, xx, 2, pp. 179–80, 1941). Applications of copper and mercuric naphthenates dissolved in gas oil gave protection to laylay trees [*Cordia lockhartii*] for 2½ years, after which they were destroyed by fungal attack. Only one portion (out of ten in each case) of white pine [*Pinus strobus*] treated with the lowest concentration of each preservative showed signs of fungal decay after six years. Highly satisfactory results against termites were recorded after treatment of white pine wood with the above preservative and with gas oil alone, and the experiments are being continued with a view to determining the full range of efficacy of this variable, but inexpensive petroleum product.

Preservative treatment of fencing posts.—*N.Z. J. Agric.*, lxxii, 2, pp. 193–196, 2 figs., 1946.

This contribution by the New Zealand State Forest Service offers advice based on the latest practice on the preservative treatment of fencing posts. A table of prescribed exposure to hot- and cold-creosote bath treatments for a number of locally used species is appended.

Neergaard (P.). **Frøspiring, frøbaarne Sygdomme, Frøafsvampning. Et Overblik over de Problemer, der for Gartneren knytter sig til Frøformering.** [Seed germination, seed-borne diseases, seed disinfection. A survey of the gardener's problems in connexion with seed production.]—Reprinted from *Frø og Gartneri, 1941*, 6, 12 pp., 1 fig., 2 graphs, 1941. [Received June, 1946.]

This is a useful summary of some important contemporary investigations on various aspects of commercial seed production, including the factors influencing germination and the temperature, water, oxygen, and (in some cases) light requirements of the seed; five important seed-borne diseases of horticultural plants in Denmark [cf. *R.A.M.*, xiii, p. 740], viz., *Ascochyta pisi* on peas, *Colletotrichum lindemuthianum* on beans [*Phaseolus vulgaris*], *Septoria apiicola* [*S. apii*], and *S. apii-graveolentis* on celery, *Stemphylium radicinum* [*Alternaria radicina*] on carrot, and *A. brassicae* and *A. circinans* [*A. oleracea*] on cabbage; and a discussion of the factors influencing (*a*) the *dosis toxica*, and (*b*) the *dosis curativa* of seed disinfectants.

Neergaard (P.). **Lysbehandlingens Inflydelse paa Levetiden hos Frø og Svampesporer.** [The influence of light treatment on the longevity of seed and fungus spores.]—*Gartnertidende, 1941*, 28, 4 pp., 3 figs., 1 graph, 1941. [Received June, 1946.]

In 1933, as part of an investigation on the influence of light on the longevity of seed and fungus spores, seeds from each of ten lots (five white cabbage and five cauliflower) of the previous year's harvest were (1) left untreated and preserved in a cork-stoppered glass container, (2) as (1) with a paraffined cork, (3) exposed for one hour to simultaneous radiation by a mercury-quartz and a Hanau Sollux lamp and preserved in a cork-stoppered glass vesssel. (4) as (3) with a paraffined cork, and (5) untreated, preserved in a leather bag. The incidence of cauliflower seed contamination by *Alternaria circinans* [*A. oleracea*] at the first examination in April, 1937, ranged from 0·0 per cent. for treatment (2) to 7·8 per cent. for (3), the corresponding figures for cabbage being from 5 per cent. for treatment (5) to 11 per cent. for (3). A year later, the cauliflower seeds exposed to treatments (1) and (2) were free from infection, while those subjected to (4) showed 7 per cent. (the same as in 1937); in the case of cabbage, the incidence of *A. oleracea* ranged

from 0·7 per cent. for (1) and (5) to 12·7 per cent. for (4). In January, 1941, when 800 seeds of each sample were sown on agar in Petri dishes, all those of cauliflower were healthy, whereas cabbage exposed to treatments (3) and (4) showed 5·6 and 3·4 per cent. infection, respectively; a month later the incidence had fallen to 1·5 and 1·8 per cent., respectively.

It is evident from these data that irradiation exerted a stimulatory effect on *A. oleracea*, especially in white cabbage, in which it persisted for a period of more than 8½ years. The question then arose whether this incentive to growth was a direct or an indirect result of the treatment, which might, for example, have altered the structure of the seed in such a way as to provide specially favourable conditions for the resting mycelium below the seed coat. In March to April, 1941, therefore, some 500 cabbage seeds of lots (1) to (4) were thoroughly rinsed in sterile water and the resultant spore suspensions passed through sterile filter paper, which was then cut into fragments and placed on malt extract agar in Petri dishes. Both the irradiated and untreated samples left thousands of spores on the filter paper, but colonies of *A. oleracea* developed only from the former, thereby demonstrating the directly beneficial action of light on the pathogen.

McLaughlin (J. H.). **Vegetable seed treatment for Oklahoma.**—*Bull. Okla. agric. Exp. Sta.* B-293, 24 pp., 1946.

The results of experiments conducted at the Oklahoma Agricultural Experiment Station, partly in connexion with the national seed treatment testing programme under the auspices of the American Phytopathological Society, and confirmed by results obtained elsewhere, show that the following chemical dusts may be most usefully employed for protecting vegetable crops against pre- and post-emergence damping-off (caused in Oklahoma chiefly by *Pythium debaryanum* and *Rhizoctonia* [*Corticium*] *solani*) in concentrations related to weight of seed: arasan (used for the first time as a vegetable seed treatment and possibly suitable for all the vegetables mentioned although not yet tested) or spergon for carrot (which should not be overdosed), cantaloupe, cucumber, okra [*Hibiscus esculentus*], and spinach at 0·5 per cent., lettuce 1, lima beans [*Phaseolus lunatus*] and watermelon 0·25, peas and edible soy-beans 0·2, and sweet corn [maize] at 0·17; spergon or vasco 4 for cabbage, turnip, eggplant, and salsify at 0·5 (the last-named can also be treated with cuprocide at the same concentration); arasan at 0·5 per cent. on beets (particularly susceptible to damping off) as beet and Swiss chard seed are unsuitable for treatment with spergon; spergon for radish and chilli pepper at 0·5 (alternative for chilli, cuprocide at the same dosage) and cuprocide for tomato at 0·5.

Methods of liquid treatment are recommended for potatoes (*Circ. Okla. agric. Exp. Sta.* 36).

Semesan, to be used according to the maker's directions, is suggested for cabbage, eggplant, chilli, tomato, and turnip.

The following percentage stand increases were obtained using seed treated with the chemicals recommended at or near the percentages given, the trials being conducted in the field except where otherwise stated; beet 128, cabbage (greenhouse) 34, cantaloupe 53, carrot 60, cucumber 162, eggplant (greenhouse) 37, lettuce 47, *P. unatus* 124, *H. esculentus* 46, peas 64, chilli (greenhouse) 19, radish (greenhouse) 3, salsify (greenhouse) 20, soy-bean 16, spinach 239, with a yield of 10,332 lb. cut spinach per acre as against 7,144 lb. from untreated seed, and watermelon 85.

Wang (C. M.). **Physiological specialization in Peronospora parasitica and reaction of hosts.**—*Chin. J. sci. Agric.*, i, 4, pp. 249–257, 1944. [Chinese, with English summary. Received June, 1946.]

The reactions of the cruciferous hosts of downy mildew (*Peronospora parasitica*), a widespread and important disease in China, especially in the Yangtse Valley, fall

into four types, namely, susceptible, with normal symptoms; resistant, showing large necrotic spots; highly resistant, characterized by barely discernible necrotic spots; and immune, with no perceptible symptoms. Three varieties of the fungus are differentiated, viz., *brassicae* on *Brassica*, *raphani* on *Raphanus*, and *capsellae* on *Capsella*: they are not cross-inoculable. *P. parasitica* var. *brassicae* comprises six physiologic races [*R.A.M.*, v, p. 711], distinguishable by their effects on ordinary and Chinese cabbage, *B. juncea*, and swede. A dichotomous key to the three varieties of *P. parasitica* and the six races of var. *brassicae* is provided.

EGLITIS (M.). **Pflanzenpathologie im Ostland. III. Mitteilung. Untersuchungen über die Möglichkeiten der Bekämpfung von Cercospora beticola Sacc.** [Plant pathology in Ostland. Note III. Investigations on the possibilities of control of *Cercospora beticola* Sacc.]—*Zbl. Bakt.*, Abt. 2, cvi, 5–7, pp. 94–104, 1943. [Received May, 1946.]

In 1937 and 1938 beet leaf spot (*Cercospora beticola*) assumed a devastating form in Estonia. The average harvest for the years 1934 to 1937 was computed at 21·25 tons per ha. and the sugar content at 18·13 per cent., while the corresponding figures for 1938 were 16·9 and 16·82, respectively, representing a loss of 20·5 per cent. of the normal tonnage and 7·2 per cent. of the sugar content. Very encouraging practical results were obtained by treatment of the seed-clusters with ceresan (0·6 gm. per 100 gm., five minutes' shaking in a glass-stoppered vessel), and the mycelium was killed by 24 hours' exposure to a temperature of 75° C. and six hours at 85°. The virulence of both mycelium and spores of the pathogen decreased in seed stored for periods of one to two years.

BERGER (K. C.) & TRUOG (E.). **Boron deficiency in Beets as correlated with yields and available boron.**—*Trans. Wis. Acad. Sci. Arts Lett.*, xxxvi, pp. 421–425, 1944. [Received May, 1946.]

Boron-deficiency symptoms in beets [*R.A.M.*, xxiv, p. 130] do not appear until the condition has assumed a serious form and caused heavy reductions in yield. A method was therefore devised for the determination of the available boron in soils, involving extraction with hot water, and this permits the detection of deficiency at an early stage when the application of a boron fertilizer is indicated. The results of field trials denoted that sugar beets require a minimum of one part per million of available boron and the table varieties slightly more. Common field crops probably need less than half these quantities.

JONES (H. A.), WALKER (J. C.), LITTLE (T. M.), & LARSON (R. H.). **Relation of color-inhibiting factor to smudge resistance in Onion.**—*J. agric. Res.*, lxxii, 7, pp. 259–264, 1946.

These experiments confirmed the view that resistance to the smudge disease (*Colletotrichum circinans*) was higher in coloured onions than in white ones [*R.A.M.*, xxv, p. 310], which are highly susceptible to that pathogen, but showed that cream bulbs with the genetic constitution *Ii* are roughly intermediate in resistance between the pure white onions and the coloured ones, and it is considered that the production of hybrid onions of this constitution would be a simple matter. In the six crosses made White Portugal was one parent in five of the crosses and was crossed with Stockton G36, Early Grano, Italian Red, Stockton Yellow Flat, and Yellow Globe Danvers, the sixth cross being Crystal Wax × Italian Red. Plants of the F_1 generation were inoculated with smudge when the bulbs were half grown. Disease indexes in the mature bulbs were: white 46 to 88, coloured 6 to 22, hybrid cream 19 to 70, the most resistant of the last-named being White Portugal × Yellow Globe.

It is suggested that the effect of the recessive white gene *c* upon resistance to *C. circinans* and the difference between the susceptibility of red and yellow varieties resulting from the action of the *Rr* pair of alleles should be studied further. Importance is attached to the fact that the highest and lowest mean indexes of susceptibility in these experiments were found in crosses between white and yellow varieties.

KUHNHOLTZ-LORDAT (M.) & GASTAUD (J. M.). **Notes de pathologie végétale.** [Plant pathological notes.]—*Ann. Épiphyt.*, N.S., ix, 2, pp. 207–219, 5 figs., 1943. [Received April, 1946.]

Sphaeropsidales reported on ivy (*Hedera helix*) leaves in the vicinity of Montpellier at various times comprise *Ascochyta diplodina*, *Phyllosticta concentrica*, *P. hederae*, and *P. hedericola* [*R.A.M.*, xii, p. 24]. The first author has not found the *P. hederae* reported by Celotti from Montpellier in 1887, and it is not in the herbarium there. He regards *P. hederacea* as a young stage of *P. hedericola*. The spots produced by *P. concentrica* are dark brown at first with concentric rings, then becoming greyish due to the formation of pycnidia. The broadly oval, sometimes subglobulose conidia measure 10 by 8 to 9 μ. *P. hedericola* causes spots which rapidly become ochre, whitish-grey, or white, sometimes with a few concentric rings at the periphery. They are surrounded by a rather light, yellow-brown band, which imparts a somewhat reddish tinge to the surrounding parts. This ring spreads out into an oil spot, and is itself surrounded by a chlorotic zone. Scattered pycnidia appear as black points and the elongated, irregular conidia measure 5 to 8 by 2 to 2·5 μ. The spots caused by *A. diplodina* also soon turn ochre, whitish-grey, or white and bear scattered black pycnidia. They are surrounded by a narrow, brown cushion sharply distinguished from the green tissues. The conidia are uniseptate rods, measuring 11 by 2 μ.

During 1941, in several parts of Hérault, fig trees became defoliated early in October, and the fruit withered or fell. Underground infection of the trunks by *Rosellinia necatrix* was noted. A key is given to the species of *Phyllosticta* (*P. mespili* and its var. *macrospora*, *P. mespilina*, and *P. mespilicola*) which have been described on medlar (*Mespilus germanica*) in northern Italy; the species attacking this host in Mediterranean Languedoc is *P. mespili*.

During May, 1941, stocks (*Matthiola incana*) growing in a bed facing south at Montpellier showed abundant external infection by *Peronospora parasitica*. Transverse sections of the infected spots showed external productions bearing no relation to the conidia. Hyphae emerged from the stomata, rose perpendicularly to the leaf surface, twisted round upon themselves, branched, and showed rolling at the extremity. They rolled round the leaf hairs or grew along their walls. Strong tufts of mycelium first invaded the substomatal cavity. It seems that in the prevailing atmospheric conditions (wet May, southern aspect) *P. parasitica* developed an ectophytic mycelium.

A distinctive character of the genus *Sphaerotheca* is a single ascus inside a perithecium with simple appendages. Whereas the perithecia are often wrongly figured with a close network outlining a large number of small alveoli, in reality, the alveoli are large, ten sometimes occupying an entire hemisphere of the perithecium. Their shape is never rectilinear, but widely sinuous. Thickening of the net occurs early, and as the perithecium grows the alveoli swell outwards, the thickened net remaining in the bottom of a hollow. A preliminary morphological study of the perithecia of *S. humuli*, using a new clearing method (equal parts of pure hydrochloric acid, density 1·19, and lactic acid, density 1·24), showed that on five different wild hosts the diameters ranged from 83 μ on *Senecio fuchsii* to 104 on *S. cordatus* and the number of alveoli from 10 to 40. The alveoli were separated from each other by furrows.

Compte rendu sommaire des travaux des Stations et Laboratoires de Pathologie Végétale en 1941. [Brief report on the work of the Plant Pathological Stations and Laboratories in 1941.]—*Ann. Épiphyt.*, N.S., viii, 2, pp. 219–223, 1942. [Received April, 1946.]

Investigations carried out at Montpellier by J. Branas and his co-workers, using a variety of metallic salts, give rise to the conclusion that no metal more active than copper against vine mildew [*Plasmopara viticola*] is likely to be found; the rare metals remaining untested, even if proved highly fungicidal, would nevertheless be virtually unobtainable. Bordeaux mixture remains the most effective form of copper. Conclusive evidence was obtained that the toxicity of metals to *P. viticola* is a periodic function of their atomic weight. At Montpellier during a cold, wet season the slight superiority of sublimed sulphur against vine *Oidium* [*Uncinula necator*: *R.A.M.*, viii, p. 750] observed in more northern latitudes was confirmed. At Bordeaux, sublimed sulphur gave completely satisfactory control. The liquids were inferior but the best of them was Bordeaux mixture with 'nekal' sticker. Bordeaux mixture, while ineffective by itself, to some extent rounded off the effect of sulphur against *U. necator*. Potassium permanganate was much less effective, though occasionally it gave good results.

Spray warnings against *P. viticola* were issued for the first time in 1941 by the stations at Avignon, Antibes, and Bordeaux, and with the happiest results. On almost every occasion the warnings coincided with the best date for spraying.

Neergaard (P.). **8. 9. 10. Aarsberetning (er) fra J. E. Ohlsens Enkes plantepatologiske Laboratorium. 1 April 1942–31 Marts 1943. 1 April 1943–31 Marts 1944. 1 April 1944–31 Juli 1945.** [Eighth, ninth, and tenth annual reports from the phytopathological laboratory of J. E. Ohlsen's widow. 1st April, 1942 to 31st March, 1943. 1st April, 1943 to 31st March, 1944. 1st April, 1944 to 31st July, 1945.]—21 pp., 1943; 18 pp., 2 graphs, 1945; 20 pp., 4 figs., 2 graphs, 1945. [English and Esperanto summaries.]

During the period from 1st April, 1942 to 31st March, 1943, 5,510 samples of horticultural seeds were tested [cf. *R.A.M.*, xxiii, p. 427] and the following new records, among others, for Denmark established: *Alternaria circinans* on *Artemisia scoparia*, *Aubrietia hybrida*, and thyme, *Ascochyta calendulae* on *Calendula officinalis* leaves; *Colletotrichum anthurii* (All.) n. comb. (syn. *Gloeosporium anthurii* All., *C. anthurii* Delacr.), with conidia averaging 15·9 by 5 μ (original diagnosis 18 to 20 by 4 to 5 μ), on foliage of *Anthurium scherzerianum*; and *C. godetiae* n. sp., characterized by conidiophores measuring 20 to 30 by 2 μ, hyaline, cylindrical, guttulate conidia, 15 to 21 by 4 to 6 μ, occasionally provided with dark brown, septate setae, 60 to 120 by 3 μ, actively parasitic on *Godetia hybrida* stems. The last-named plant is particularly susceptible to fungal infection, harbouring besides the foregoing *Alternaria tenuis*, *A. tenuissima*, *Botrytis cinerea*, *Phoma* sp., *Stemphylium* sp., *Coniothyrium* sp., *Fusarium* sp., *Marssonina* sp., various moulds, and *Pythium debaryanum*. Of the various seed treatments tested against these pathogens, the most effective were four hours' immersion in 0·5 per cent. Danish uspulun and 0·5 per cent. tillantin. Pomarsol [ibid., xxiv, p. 453] also gave encouraging results, notably in respect of *B. cinerea*, infection with which on the Kelvedon Glory variety was reduced from 11·3 to 0·5 per cent. by an hour's immersion at 0·8 per cent. in one test, and from 9·3 to 0·3 per cent. by the same period at 1 per cent. in another without impairing germination.

In an experiment to determine whether certain pathogens of *G. hybrida* secrete metabolic products toxic to the host, sterilized seeds of Kelvedon Glory and Bijou were germinated in Petri dishes on filter paper moistened with 10, 25, and 50 per cent. filtrates of malt-extract culture solutions of pathogens. Only *S. radicinum* [or *A. radicina*] produced toxins exerting a definitely deleterious effect on

the seeds, which germinated poorly and gave rise to stunted, blackish-brown seedlings.

Between 1st April, 1943 and 31st March, 1944, the examination of 5,322 seed samples disclosed the presence of two new species of *Alternaria*, *A. matthiolae* [= *A. raphani* fide Neerg.] on *Iberis amara* and *I. umbellata*, and *A. senecionis*, the agent of cineraria (*Senecio cruentus*) leaf spot; of a new record for Europe, *Peronospora mesembryanthemi* on *Mesembryanthemum* leaves, originally reported by L. Verwoerd from South Africa (*Ann. Univ. Stellenbosch*, Ser. A, 1, 1924); and of new hosts for *A. circinans* (seakale: *Crambe maritima*) and *A. zinniae* [*R.A.M.*, xxi, p. 492] (China aster: *Callistephus chinensis* and cineraria).

The results of inoculation experiments on seedlings of seven varieties of *G. hybrida* with *A. circinans*, *A. porri* f. sp. *dauci* (Kühn) Neerg., *A. porri* f. sp. *solani* (Ell. & Mart.) Neerg., *A. tenuissima* var. *godetiae* Neerg., *S. radicinum*, and its var. *petroselini* Neerg. indicated that Kelvedon Glory, Sybil Sherwood, and Duke of York are the most susceptible to all the fungi and Bijou the least so, Azaleiflora fl. pl., Gloriosa, and Lady Satin Rose being intermediate in their reactions. In inoculations into Kelvedon Glory seedlings and mature plants, the former were severely attacked by *B. cinerea* and *P. debaryanum*, and slightly by *C. godetiae* and *Phoma* sp., while the latter sustained fairly heavy infection by *B. cinerea* and *C. godetiae* and little or none by the other two organisms. Inoculation tests with *A. circinans* on *Capsella bursa-pastoris*, unlike those of [P. A.] Young [ibid., v, p. 622], gave positive results.

Among the new host records for the period from 1st April, 1944 to 31st July, 1945, when tests were conducted on 4,442 seed samples, may be mentioned *A. circinans* on *G. hybrida* seeds and *Centrospora macrospora* (Osterw.) Neerg., causing severe root rot of *Primula malacoides*, while *Marssonina kriegeriana* as the agent of a serious disease of *Salix alba* var. *tristis* [cf. ibid., ix, p. 813] and mosaic of *Impatiens sultani* have not hitherto been reported in Denmark.

A. tenuissima var. *godetiae* Neerg. 1945 is raised to specific rank as *A. godetiae* (Neerg.) n. comb.

A summary is given of the organization and activities of the Ohlsen phytopathological laboratory during its first ten years of operation (1935–45).

Annual Reports of the New Hampshire Agricultural Experiment Station for the years ending June 30, 1942, June 30, 1943, and June 30, 1944.—*Bull. N. H. agric. Exp. Sta.* 345, 67 pp., 5 figs., 1942; 351, 66 pp., 4 figs., 1943; 354, 67 pp., 1944. [Received April, 1946.]

The following are among the items of phytopathological interest in these reports [cf. *R.A.M.*, xx, p. 103]. M. C. Richards and R. W. Barratt tested a number of sprays for the control of muskmelon powdery mildew [*Erysiphe cichoracearum*] in 1941–2. Severe foliar burning followed the use in the greenhouse at temperatures of 70° to 95° F. of kolofog, Koppers flotation sulphur, and potassium sulphide in dilutions ranging from $\frac{1}{4}$ to 6 lb. per 100 gals. Of the copper compounds tried, viz., copper oxychloride sulphate (1 in 100 to 2 in 100), Bordeaux mixture (1 in 150), and cuprocide (1 in 100), the first-named was the most satisfactory, though it caused some damage. In 1942–3 the incorporation of emulsified cotton seed or groundnut oil (1 in 800) with copper oxychloride sulphate ensured an even deposit and obviated burning of the leaves. Tests by M. C. Richards indicated that potato tubers showing symptoms of net necrosis, caused by the leaf-roll virus, may be differentiated with a high degree of accuracy in the spring-grading inspection from those with stem-end browning [ibid., xxiii, p. 272].

Repeated experiments by M. C. Richards (with H. R. Barratt in 1943–4) indicate that the causal organism of potato ring rot [*Corynebacterium sepedonicum*], first detected in New Hampshire in 1941, either does not overwinter in the soil or that

infested soil does not serve as a source of inoculum in the central regions of the State.

Numerous commercial tomato varieties, selections, and species of *Lycopersicon* were tested in 1943–4 by M. C. Richards for resistance to late blight (*Phytophthora infestans*). Besides the first-named category, *L. pimpinellifolium*, *L. chilense*, and *L. peruvianum* proved highly susceptible, but a few selections of *L. hirsutum* showed some resistance to a potato isolate of the fungus.

In 1943–4 M. C. Richards compared fermate (1½–100) and mike sulphur (6·6–100) for the control of apple scab [*Venturia inaequalis*] on McIntosh, the schedule comprising the pink, bloom, calyx, and four cover sprays. In a third treatment, Bordeaux mixture was applied in the third and fourth covers to certain trees sprayed with mike sulphur. The numbers of scab spots per leaf in the sulphur, fermate, and Bordeaux plots were 7·47, 6·21, and 2·39, respectively, the percentage of diseased apples 4·80, 3·61, and 3·24, respectively, and the percentage of russeted fruits 2, 7·12, and 4·23, respectively.

Fifty-seventh Annual Report of the Texas Agricultural Experiment Station, 1944.—49 pp., 65 figs. [? 1945. Received May, 1946.]

This report [cf. *R.A.M.*, xxiv, p. 355] contains, *inter alia*, the following items of interest. A new variety of Sudan grass, called Sweet Sudan grass, developed at the Texas Agricultural Experiment Station, is sweet and juicy, like the sweet sorghums, and also resistant to common foliage diseases. Several new, satisfactory sorghum varieties have been developed that are adapted to machine harvesting, and some, including Plainsman, Caprock, and Bonita, are now widely grown. All these three are resistant to *Pythium* root-rot [commonly attributed to *P. arrhenomanes* but now thought due to a complex of factors: ibid., xxiii, p. 101]. A new variety of cantaloupe melon, Texas cantaloupe No. 1, resistant to downy mildew [*Pseudoperonospora cubensis*] and aphids, was expected to be released to growers in June, 1945.

Fifty-fifth Annual Report for the fiscal year ended 30th June, 1945.—*Bull. Wash. St. agric. Exp. Sta.* 470, 167 pp., 1945.

In the section of this report [cf. *R.A.M.*, xxiv, p. 267] dealing with plant pathology (pp. 62–68), S. B. Locke states that during 1944 certified tubers of 16 potato varieties were grown at Harrah, Everson, and Pullman. In the spring of 1945 seed tubers from these stocks were planted at Harrah. The incidence of tuber-transmitted leaf-roll in the Harrah seed averaged 34 per cent., as against 7·3 and 5·8 per cent. for the Everson and Pullman seed, respectively. Earlaine No. 2 was resistant in all three localities; Pawnee, Houma, Sequoia, Sebago, and White Rose were resistant in two; Katahdin, Bliss Triumph, Seedling 5703, Rural New Yorker, and Gold Coin were resistant in one; while Russet Burbank, Green Mountain, Earlaine, Chippewa, and Burbank showed no resistance. The respective reactions of two varieties in one area were often reversed in another. The combined data for all varieties in all the localities showed that as leaf-roll increased from 0 to 15 per cent., reduction in yield increased rather rapidly to 28 per cent. The percentage reductions with 25, 50, and 65 per cent. leaf-roll were 50, 70, and 81, respectively. The ratio of small tubers to U.S. No. 1 tubers increased with increasing amounts of leaf-roll.

J. D. Menzies states that propagation of scion wood from Italian prune trees with various disease symptoms on to peach and myrobalan [*Prunus divaricata*] nursery seedlings showed that a leaf-spot condition and a mottled leaf symptom were both bud-perpetuated, while a leaf-curl reaction was not. A disease indistinguishable from Santa Rosa mosaic [? peach mosaic] was observed on Santa Rosa plum in three orchards, and a mosaic-like mottle causing severe leaf and fruit

distortion on Tragedy plum is also under investigation. Spread of cherry rusty mottle [ibid., xxiv, p. 324], causing increasing damage in the lower Yakima Valley, is being surveyed.

Lucerne witches' broom again caused serious damage near Winthrop, Okanagan County. Confirmation was obtained that *Platymoideus acutus* is a vector of the virus, but other vectors probably exist.

Annual records of the degree of *Rhizoctonia* [*Corticium solani*] infection in potatoes in the rotation plots show that there is great variability in the yearly occurrence of the stem-lesion stage, while the amount of sclerotial formation on tubers is not well correlated with the degree of stem-lesion injury, but is more consistently related to cropping practice. Short rotations without legumes are conducive to severe sclerotial development, whereas two- and four-year rotations with sweet clover [*Melilotus alba* and *M. officinalis*] showed relatively little. In seven-year rotations potatoes immediately following four years of lucerne had the least sclerotial infection, increasing amounts occurring in crops two and three years removed from the legume. Most infection occurred with continuous potato culture and in the two-year potato-wheat rotations. Potatoes alternating with maize or sugar beets were less severely affected.

In second-year field tests with 647 strawberry varieties and hybrids, L. Campbell found that 18 showed symptoms of yellows [yellow edge: ibid., xxii, p. 240]. Leaf spot (*Mycosphaerella fragariae*) [ibid., xxi, p. 533], leaf scorch (*Diplocarpon earliana*) [ibid., xviii, p. 692; xxi, p. 463], and powdery mildew (*Sphaerotheca humuli*) [ibid., xix, p. 107] occurred seriously on 24, 11, and 18, respectively. These hybrids were affected by the genetic weakness 'June yellows' [ibid., xxi, p. 463]. During the second year's growth, 216 strawberry varieties and hybrids were tested in the field for relative susceptibility to root rot [ibid., xxii, p. 240]. Data based on top symptoms and confirmed by the amount of root injury showed that 26 were very susceptible, 119 moderately susceptible, 55 moderately resistant, and 16 highly resistant.

Each of nine different fungicides mixed into the soil in strips failed to control beet black root [ibid., xxii, p. 508], incidence under field conditions ranging from 84·4 to 95 per cent. Incidence of black root in soil treated with superheated steam by machinery was 33·47 per cent. as against 76·61 per cent. in untreated soil.

C. S. Holton states that one recently collected race of *Tilletia caries* [cf. ibid., xxi, p. 284; xxiv, p. 267; xxv, p. 209] appears to be new. Five experimentally produced bunt hybrids representing distinct races tested for seven to ten generations are regarded as pathogenically stable. Two of seven hybrid selections of winter wheat were highly resistant to all races of bunt (*T. caries* [and *T. foetida*?]) [ibid., xxv, p. 298], both being previously untested selections from a Rex × Rio hybrid. Of four spring wheats tested, Doubbi, an Australian durum wheat, was resistant to all races except T-2 (the durum wheat race), whereas Idaed and Hard Federation were susceptible to all races and Marfed resistant to only four. Susceptibility to dwarf bunt [*T. caries*: loc. cit.] was shown by seven out of 33 varieties of winter wheat in one test.

Further work indicated that only one race (No. 2) of wheat flag smut, *Urocystis tritici*, is prevalent in the Goldendale area; the resistance of the Golden variety remained outstanding.

No further races of oat smuts [*Ustilago avenae* and *U. kolleri*] were identified in ten collections tested. One collection represented Race A-14, and six A-15, both newly identified last year and economically significant owing to their virulence towards the Victoria type of resistance. Varieties and hybrids tested showed a high degree of smut resistance, 12 being highly resistant to 22 races, and none susceptible to more than three.

In studies by M. L. Schuster on pea damping-off and root and stem decay, about 50 per cent. of the isolates from seed and seedlings from 1942 to 1945 inclusive, were *Fusarium solani* f. *pisi*. Susceptibility was ascertained to be conditioned by many factors. A highly significant correlation co-efficient was obtained between emergence from untreated and from spergon-treated seed. Variations in stand ranging from 27 to 100 per cent. were noted in 55 seed lots of the same variety. Laboratory germination tests do not always give a good indication of field performance, even of treated seed, particularly if the peas are wrinkled. The iodine bath was as effective as the water dip for determining the amount of cracking. Treatment increased emergence from chipped seed as well as from sound seed. Watering immediately after planting may cause dissipation of seed protectants. Under dry soil conditions, an organic mercury compound may induce root damage. Excess or deficiency of soil moisture may condition the value of seed protectants. In one of two localities, seed treatment was significant in relation to dates of planting, greater response being noted in the earlier sowing. Poorer stands resulted from seed that remained longer in the soil, but seed treatment equalized this difference.

G. W. Fischer studied 45 new collections of head smut (*U. bullata*) of forage grasses, mainly from the Pacific North-west. Of the 12 known physiologic races, races 1, 2, and 12 were identified 11, 17, and 7 times, respectively. Conclusive evidence was obtained that new improved ceresan used at maximum dosage (i.e., amount adhering to the treated seed after the excess has been screened off), is completely toxic. Thiosan gave complete control of the disease in all replications and on all four grass species used, and all the stands were good. Arasan was somewhat inferior to thiosan; spergon gave poor control.

Of 73 collections of stem [black] rust on grasses made in eastern Washington in 1943–4, 40 were identified by test inoculations as *Puccinia graminis tritici*, 12 as *P. g. avenae*, two as *P. g. secalis*, and two as *P. g. phlei-pratensis*.

Rybak (B.). **Sur l'immunité dans le cas du crown-gall chez Pelargonium zonale.** [Immunity in the case of crown gall in *Pelargonium zonale*.]—*C.R. Acad. Sci., Paris*, ccxxii, 25, pp. 1462–1464, 1 fig., 1946.

The hypersensitive reactions in the form of longitudinal fusiform fissures in the stem, described by Magrou as characteristic of *Pelargonium zonale* [*R.A.M.* xvii, p. 799] reinoculated with a virulent strain of *Bacterium tumefaciens* [see next abstracts] at a distance from the original site of infection, can also be induced by the inoculation of healthy stems with the bacterium killed by one hour's exposure to a temperature of 56° C. The immunity conferred, however, is purely transient, reinoculation with virulent isolates of the pathogen resulting in the formation of tumours even in the regions of the first inoculation, though the secondary excrescences remain minute.

The hypersensitive reactions are due to a process of cellular detoxication. Under the influence of the bacterial toxins the host cells proliferate actively, thereby liberating an abundance of waste products which diffuse and accumulate slowly at variable, but always short, distances from the point of invasion. The reinoculation, after a month or two, with a virulent strain of the bacterium into the cells adjacent to the tumour initiates a similar process of detoxication, but the sensitization induced by the toxic products of the growth results in the death not only of the cells in immediate proximity to the new sites of invasion, but also of those in the directly over- and underlying layers which are permeated by the toxins. The consequent desiccation causes the separation of all these suberized cells and tangential tension leads to the fusiform rupture.

In the case of inoculation with bacteria killed by heat, the toxins diffuse longitudinally at a very short distance from the site of invasion. Mitogenetic in

doses, these toxins become necrobiotic in massive concentrations of the order proper to bacteria undergoing autolysis. The stem fissures are much narrower and shorter than those induced by inoculation with virulent isolates near a tumour.

MAGROU (J.) & MANIGAULT (P.). **Action du champ magnétique sur le développement des tumeurs expérimentales chez Pelargonium zonale.** [Action of the magnetic field on the development of experimental tumours in *Pelargonium zonale.*]—*C.R. Acad. Sci., Paris,* ccxxiii, 1, pp. 8–11, 1 fig., 1 diag., 1946.

The growth of tumours artificially induced in *Pelargonium zonale* plants of the Jardin des Plantes variety by inoculation through an internode with the *Chrysanthemum frutescens* strain of *Phytomonas* [*Bacterium*] *tumefaciens* [see preceding abstract] was almost completely inhibited by exposure to a magnetic field, whereas the excrescences in the controls attained a diameter of 8 to 12 mm. in 67 days. The anatomical structure of the magnetized tumours did not differ from those of the controls.

GIOELLI (F.). **Produzione di tumori per mezzo del Bacterium tumefaciens su culture 'in vitro' di tessuti vegetali.** [The production of tumours by means of *Bacterium tumefaciens* on '*in vitro*' cultures of plant tissues.]—*Nuovo G. bot. ital.*, N.S., xlvii, 2, pp. 452–453, 1940. [Received April, 1946.]

Continuing his investigations on the growth-promoting effects of *Bacterium tumefaciens* [*R.A.M.*, xix, p. 462], the author induced, by inoculation with living bacteria, the formation of large tumours on pieces of living carrot root cultured *in vitro* at 28° to 30° [C.] in the light. These tumours were larger and more prolific than the neoplastic proliferations induced by filtrates of the bacterial cultures and were localized at the point of inoculation. They were produced also in the dark but less markedly. If the carrot tissues were not living the bacterium merely multiplied saprophytically in them. Microscopic examination showed that the tumours were similar in structure to the neo-formations induced by filtrates, that the bacteria were present only in the superficial layers, were intracellular, and did not kill the cells or multiply abundantly in them.

JOHNSON (T.) & NEWTON (MARGARET). **Specialization, hybridization, and mutation in the cereal rusts.**—*Bot. Rev.*, xii, 6, pp. 337–392, 1946.

In this paper the authors briefly review, with numerous references to the literature of the subject, the main contributions to knowledge that have accrued as a result of the discoveries of physiologic specialization and heterothallism in cereal rusts (*Puccinia* spp.). The headings under which the subject is treated include physiologic specialization of each important rust separately, the reaction of physiologic races to environment, economic significance of physiologic races, hybridization (nuclear phenomena, methods of crossing and selfing, rust characteristics suitable for study, selfing of physiologic races, and crossing studies), and mutation. A bibliography of 242 titles is appended.

GUYOT (A. L.). **Études expérimentales sur les Uredinées hétéroiques.** [Experimental studies on the heteroecious Uredinales.]—*Ann. Éc. Agric. Grignon,* Sér. 3, ii, pp. 124–128, 1940–1; iii, pp. 93–99, 1942; iv, pp. 116–147, 1944. [Received January, 1946.]

In these three papers the author's work on rusts [*R.A.M.*, xix, p. 367] is extended. In the first he records the parasitic specialization of certain species of *Uromyces* living on legumes in the Paris basin and the plains of northern France, and having their aecidial stage on *Euphorbia cyparissias*. Peas were slightly attacked by a form of *U. pisi* late in 1937, 1938, and 1939. He summarizes also the parasitism of *Uromyces* on members of the Caryophyllaceae.

The second study made in 1941 treats of several species of *Puccinia* parasitic on the Gramineae. Infection experiments with seven species of *Bromus*, using aecidiospores from *Thalictrum minus*, confirmed the view that this rust was *P. alternans* f. *bromi-erecti*. *P. bromina* was collected from *B. sterilis* and *B. mollis*. Stems of *Avena elatior* were found harbouring *P. coronata*, which proved easily transmissible to other plants of the same species, but not to those of seven other species of *Avena*. Teleutospores of *P. coronata*, collected in the autumn on *A. elatior* and on *Bromus* spp. and left to hibernate outside, produced basidiospores which infected *Rhamnus cathartica* and *R. utilis* the following spring.

In experiments to determine the spring cycle of yellow rust (*P. glumarum*), wheat seedlings reared under glass were exposed outside for seven-day periods during May. No infection resulted during the period from 1st to 18th May; first infection appeared between 18th and 22nd May, uredosori appearing on 3rd June; a second occurred between 25th and 29th May, uredosori appearing on 10th June; whence it seems that the incubation period is from 12 to 15 days. Some confirmation of these results was afforded by field observations of cereals and by open-air sowings of Gramineae. While *P. glumarum* infection of autumn sown wheat and barley and also of wild grasses (*Agropyron repens* and *Hordeum murinum*) was observed from 28th April, the disease did not become manifest on experimental spring sowings of Gramineae in the open air until 6th June, the first uredosori appearing at the same time on *Triticum durum*, *T. spelta*, *T. vulgare*, *Agropyron caninum*, *A. glaucum*, and *Bromus arvensis*, probably from a first period of infection occurring about 20th May. The development of *P. glumarum* on wheat was somewhat intense, a few teleutosori being noted on 22nd July (although they appeared on 13th June on winter barley), but the uredosori were still active on 5th August on leaves not already completely withered.

P. graminis was first seen on winter wheat on 15th July, and the first teleutosori appeared on the 19th. On 22nd July the disease became evident on spring-sown rye; the uredo stage on *H. maritimum* was seen on 5th August; while on 14th October uredosori of *P. graminis* were still numerous on stems and ears of *Lolium perenne*. Winter barley bore uredosori and teleutosori of *P. simplex* [*P. anomala*] from 6th June; and the first uredosori of *P. triticina* [on wheat] appeared on 4th July, no teleutosori being noted.

In the third study covering 1942 and 1943 notes are presented on the time and extent of the incidence of species of *Puccinia*. *P. bromina* was observed on *Bromus* spp. in both years, as was *P. coronata*, which occurred also on *Rhamnus* spp. in both years and on experimentally exposed oats and *A. fatua* and on many grasses in 1943. Uredosori of *P. dispersa* were first observed on rye on 3rd June in 1942 and on 27th May in 1943, the teleutosori appearing on 26th June, 1942, but not in 1943. The dates of appearance of *P. glumarum* on wild grasses are given. Cereals were badly attacked in June, 1942, the wheat varieties Vilmorin 23 and 27 being seriously affected, Hybrid 40 and Pont Caillou only slightly so, while Ile de France was practically resistant. Further exposure experiments, using seedlings of wheat (Hybrid 40 and Vilmorin 23), barley (winter and spring), and bromes confirmed the findings of the previous year and established that favourable periods for infection alternate with unfavourable periods. A list of hosts of *P. glumarum* for the Grignon region is given. *P. graminis* appeared in 1942 on the experimental plots of winter wheat, where it was very active in early July, and on barley and oats particularly at the end of July. Rye remained unaffected even near other infected cereals. In 1943 there was intense early infection mostly on wild grasses. Infection experiments on a variety of seedling grasses under glass in 1942 and more extensively in 1943, the results of which, together with numerous uredospore measurements, are fully tabulated, established that there are a number of biolog races of *P. graminis* in the Grignon region. Those on cereals have larger ured

spores (29 to 33 μ long) than those on wild grasses (up to 27 μ long). A scheme setting out the succession of these strains on the various hosts during the season is given. Wheat appears to have two strains, one early and the other late. *P. persistens* occurring on *Thalictrum glaucum* was used to infect *Agropyron* spp. and wheat. *P. poarum* from *Tussilago farfara* infected *Poa* spp. *Puccinia anomala* infection appeared repeatedly from mid-May to mid-July on experimental barley. *P. triticina* was active on wheat from the end of June and on the experimental plots from 17th June in 1942; in 1943 it appeared on 2nd June.

GUYOT (L.). **Étude biométrique de Puccinia graminis (rouille noire des Graminées),** [A biometric study of *Puccinia graminis* (black rust of Gramineae).]—*C.R. Acad. Sci., Paris*, ccxx, 19, pp. 700–701, 1945.

The examination by the author and A. Saccas of nearly 10,000 uredo- and teleutospores from 262 samples of cereal black rust (*Puccinia graminis*) collected in various parts of the Old World revealed dimensional disparities of sufficient magnitude to justify their relegation to the following new subspecies or varieties: subsp. *minor* on *Anthoxanthum* and *Cynosurus*: uredo- and teleutospores (mean) 22 to 25 by 15 to 17 μ and 30 to 45 by 18 and 21 μ, respectively; subsp. *media* on *Agrostis, Aira, Alopecurus, Arrhenatherum, Calamagrostis, Dactylis, Festuca, Hordeum* (wild), *Lolium, Phleum, Poa, Vulpia*: 22 to 30 by 15 to 19 μ and 31 to 51 by 16 to 22 μ, respectively; var. *erikssoni* on *Agrostis, Aira, Alopecurus, Arrhenatherum, Dactylis, Festuca,* and *Hordeum* (wild): 23 to 30 by 15 to 18 μ and 37 to 50 by 16 to 22 μ, respectively; var. *calamagrostidis* on *Calamagrostis*: 25·8 by 16·4 μ and 46 to 51 by 19 to 21 μ, respectively; var. *lolii* on *Lolium*: 22 to 27 by 15 to 18 μ and 31 to 44 by 17 to 21 μ, respectively; var. *vulpiae* on *Vulpia*: 23 to 26 by 15 to 18 μ and 47·5 by 20·7 μ, respectively; subsp. *major* on *Aegilops, Agropyron, Avena, Bromus, Elymus, Hordeum* (cultivated), *Secale, Triticum*: 24 to 36 by 15 to 20 μ and 42 to 60 by 16 to 23 μ, respectively; var. *stakmani* on *Agropyron, Avena, Bromus, Hordeum* (cultivated), and *Secale*: 24 to 31 by 15 to 20 μ and 42 to 57 by 16 to 23 μ, respectively; var. *tritici* on *Aegilops* and *Triticum*: 28 to 35 by 17 to 20 μ and 45 to 58 by 17 to 22 μ, respectively; and var. *elymi* on *Elymus*: 29 to 36 by 17 to 19 μ and 54 to 60 by 18 to 23 μ, respectively.

WALLIN (J. R.). **Parasitism of Xanthomonas translucens (J. J. & R.) Dowson on grasses and cereals.**—*Iowa St. Coll. J. Sci.*, xx, 2, pp. 171–193, 11 figs., 1 diag., 1946.

The outbreak in Iowa on *Bromus inermis* in the autumn of 1941 of a bacterial leaf disorder not previously recorded on this host, causing brown or blackish, saturated, hyaline streaks on the foliage in fields and pastures, led to the recovery from the streaks of a yellow bacterium, which proved morphologically, culturally, and biochemically similar to the barley, rye, and wheat strains of *Xanthomonas translucens* [*R.A.M.*, xxv, p. 337]. The disease on barley and rye has been known as bacterial blight and on wheat as black chaff but since the symptoms are so much alike on all hosts the author proposes the name '*Xanthomonas* streak'. In subsequent studies over three years, the suspected overwintering of *X. translucens* [ibid., xx, p. 489] was established in brome and timothy [*Phleum pratense*] foliage in the field and the reinoculation of young leaves in the spring from these sources was demonstrated. The brome-grass race, as shown by the like reactions of six isolates in cross-inoculation tests on barley *B.* spp., rye, wheat, and oats, is considered distinct from Hagborg's *X. translucens* f. sp. *cerealis* [ibid., xvi, p. 91] which is raised to varietal rank. Six pathogenic races of *X. translucens* var. *cerealis* have been differentiated. They all attack barley, *B.* spp., *Agropyron repens*, oats, rye, and wheat, but the following differences in their behaviour on seven oats varieties and thirteen *B.* species, including two varieties of *B. inermis*, have been observed:

race I attacks Marion and Erban oats, but not *B. popovii* or *B. pumpellianus*; race II parasitizes Marion and Erban oats, but not *B. inermis* var. Fischer, *B. popovii*, *B. pumpellianus*, *B. tomentellus*, or *B. tectorum*; race III infects Marion, C.I. 4301, and Erban oats, but is inactive on *B. inermis* var. Fischer, var. 951, and *B. pumpellianus*; race IV attacks Boone, Marion, Clinton, and Erban oats, and all *B.* spp.; race V infects Boone, Marion, Tama, Clinton, C.I. 4301, Erban, and C.I. 4327, but *B. inermis* var. 951 and var. Fischer and *B. popovii* are immune from it; while race VI is a pathogen on Marion, Clinton, C.I. 4301, Erban, and C.I. 4327 and all 13 *B.* spp.

WANG (T. H.). **Crossing inoculation experiments of loose smut collected on common Wheat and turgidum Wheat.**—*New agric. J. Fukien, 1942*, 2, pp. 396–403, 1942. [Chinese, with English summary. Received 1946.]

Cross-inoculation experiments by the direct contact, spore-suspension, and partial-vacuum methods with six collections of loose smut (*Ustilago tritici*) from *Triticum turgidum* and eight from common wheat in south-western China established the existence of two physiologic races of the pathogen. The one from common wheat caused 64 per cent. infection on the three *T. vulgare* varieties tested, i.e., Tsing-Hwa University Nos. 507, 519, and 540, but did not attack the three of *T. turgidum* (T.H. 383, 444, and 10187), whereas the race from *T. turgidum* produced 41·1 per cent. smut on the varieties of this species but was almost innocuous to common wheat (0·4 per cent.).

KO (S. Y.), TORRIE (J. H.), & DICKSON (J. G.). **Inheritance of reaction to crown rust and stem rust and other characters in crosses between Bond, Avena byzantina, and varieties of A. sativa.**—*Phytopathology*, xxxvi, 3, pp. 226–235, 1 graph, 1946.

At the Wisconsin Agricultural Experiment Station a study was conducted on the mode of inheritance of reaction to crown and stem [black] rusts of oats (*Puccinia coronata* and *P. graminis*), several kernel characters, and earliness between crosses involving certain varieties of *Avena sativa* and Bond (*A. byzantina*) [*R.A.M.*, xix, p. 206].

The segregation ratios for crown-rust reaction in all the crosses except Bond × S.D. 334 are explicable either on the hypothesis of two complementary factors carried by Bond [loc. cit.], or on that of two factor pairs, S a factor for resistance to the disease and I a factor partly inhibiting the operation of S, as suggested by Torrie [ibid., xix, p. 399]. Plants heterozygous for both factor pairs were more susceptible in the field than in the greenhouse.

A single factor pair with dominance of resistance governed the response of the crosses to black rust.

CROSIER (W.). **Chemical control of seed-borne fungi during germination testing of Peas and Sweet Corn.**—*Phytopathology*, xxxvi, 2, pp. 92–99, 1946.

All the chemical preparations used in these germination tests, viz., 0·15 per cent. (by weight) arasan [see next abstract], 0·06 per cent. Du Pont 1452 C (7·7 per cent. ethyl mercury para-toluene sulphonalide), 0·22 per cent. semesan jr., and 0·11 per cent. United States Rubber Compound No. 604 (2,3-dichloro-1,4-naphthoquinone), gave partial control of the seed-borne fungi of Stowell's Evergreen Sweet Corn [maize], Du Pont 1452 C being particularly effective. The increased germination of the treated seed was parallel with the control of *Diplodia zeae* [*R.A.M.*, xxv, p. 332], but there was no evidence that *Rhizopus nigricans* [*R. stolonifer*] alone exerted any adverse effect in this respect. Only one of the chemicals, U.S.R. No. 604, was phytotoxic to the maize seed, judging by the size and development of the seedlings; all the others, in fact, increased the green weight of the combined seed and seedlings.

U.S.R. No. 604 was rather more effective than arasan, 0·2 per cent. ceresan, semesan, and 0·2 per cent. spergon in the control of Thomas Laxton pea seed moulds and bacteria [ibid., xviii, p. 495], but arasan and ceresan gave the heaviest weight increases. Arasan and spergon were the most efficient protectants of pea seeds planted in soil naturally infested with *Fusarium* spp., *Pythium ultimum*, and *Rhizoctonia* [*Corticium*] *solani*, permitting only 5 per cent. decay.

Crosier (W.) & Patrick (S.). **Arasan for control of fungi in germinating Corn seed.**—*Phytopathology*, xxxvi, 2, pp. 162–164, 1946.

Rhizopus nigricans [*R. stolonifer*] on fairly clean germinating maize seed was effectively combated by arasan [see preceding abstract] alone or mixed with wheat flour in the proportions of 67 : 33, 50 : 50, and 33 : 67, giving arasan adherence of 2·3, 1·3, 0·9, and 0·6 oz. per bush., respectively. On heavily infested seed, however, containing 8 to 20 per cent. dead kernels, the situation of the mould beneath the pericarp tended to protect it from superficial contact with the fungicide, and the two higher concentrations were more effective in such cases. The incidence of *Diplodia zeae* and *Fusarium* spp. in the seed was low, but their development on treated seed was retarded and the size of the colonies reduced. The increases in the green seedling weight of the treated seed lots are probably attributable to some other factor besides fungal control.

Kent (G. C.). **Some factors in the production and germination of spores of Diplodia zeae in culture.**—*Iowa St. Coll. J. Sci.*, xx, 2, pp. 259–263, 1946.

In laboratory tests it has been found that the germination of spores of *Diplodia zeae* [*R.A.M.*, xvi, p. 245] may vary from 0 to 99 per cent. Experiments with a number of nutrient media showed that the formation of pycnidia and germinable conidia was greatest on a thin stratum of oatmeal extract agar in an Erlenmeyer flask incubated at 20° C. in light. Spores washed in sterile water germinated better than those not washed and carrot extract was the most favourable suspending liquid. Washed spores in this medium showed 90 per cent. germination after 12 hours at 28° to 30°.

Ullstrup (A.). **An undescribed ear rot of Corn caused by Physalospora zeae.**—*Phytopathology*, xxxvi, 3, pp. 201–212, 3 figs., 1946.

Maize in Indiana has been affected for some years by a hitherto undescribed ear rot, the generally low incidence of which rose locally to 10 per cent. in 1944. Premature bleaching of the husks is the first symptom of infection, followed by the gradual cohesion of the husks and their attachment to the kernels through the growth of the felty, white mycelium, which soon shows irregular, grey blotches and streaks, especially near the base of the ear, while the black sclerotia beneath the pericarps impart a speckled appearance to the kernels. Heavily infected kernels are often black at the tip, the discoloration extending for varying distances towards the crown. Under humid conditions the seed coat shows black streaks, and in severely infected kernels the embryo is completely overrun by the black mycelium, the stromatic layers of which are frequently visible below the seed coats. There is a certain amount of shredding of the cob at the ear base, and the husks of completely decayed ears are dark grey, the cobs and kernels being reduced to a dry, grey-black, pithy mass. Infection generally occurs near or through the butt of the ear, but occasionally the tip may be the site of invasion.

The grey ear rot (the common name proposed for the disease) may be distinguished at a relatively early stage from the similar infection caused by *Diplodia zeae* by the slate-grey coloration and the presence of black sclerotia in the cob, while the grey-black hue and dry pithiness of entirely rotted ears are further differential features.

In comparative cultural studies on the grey ear-rot fungus, *Macrophoma zeae* [*R.A.M.*, vi, p. 755], and *Physalospora zeae* [ibid., x, p. 305], the marked similarities between the three organisms, e.g., as regards growth rate (32·4, 32·5, and 32·6 mm. daily increment, respectively), loss of viability by all in a little over a year, and the development of apparently non-functional pycnidia in the life-cycles strongly suggested an interrelationship. In further experiments to verify this hypothesis, cultures of the grey-rot fungus and of *P. zeae* on sterile maize stalks produced pycnidia and pycnospores identical with those of *M. zeae*, whence it is inferred that the grey ear-rot fungus is *M. zeae*, the latter being the imperfect state of *P. zeae*. Further evidence in support of this view was afforded by the results of field inoculations on maize ears, in which the symptoms induced by *P. zeae* were indistinguishable from those observed on ears naturally or artificially infected by *M. zeae*. *P. zeae* differs from *P. zeicola* (*Diplodia frumenti*) [ibid., xii, p. 366] in its symptomatology and morphology, the asci and ascospores of the former (Indiana collections) measuring 90 to 175 by 12 to 18 and 21 to 33 by 8 to 11 (mean 26·8 by 10) μ, respectively, and those of the latter 95 to 140 by 10 to 13 and 13 to 27 by 6 to 11 μ, respectively.

A hithero unrecognized fruiting body, believed to represent a stage in the life-cycle of *P. zeae*, consists of carbonous, globose pycnidia, 150 to 250 μ in diameter, protruding from the host mesophyll by means of a long neck, sometimes bi-, rarely trifurcate, with numerous non-germinating, hyaline, unicellular microspores, 2 to 4·8 by 1 to 2 (mean 4 by 1·6) μ, exuded in droplets of a mucoid matrix. The function of these organs, if any, in the perpetuation of the fungus is still obscure, and the factors promoting the spread and the development of the disease are likewise in doubt, though a reasonable assumption is that leaf infections, either of the previous or current year, are the main source of inoculum. The ploughing-under of infected maize debris is the only control measure practicable in the light of present knowledge.

Olive (L. S.), Lefebvre (C. L.), & Sherwin (Helen S.). **The fungus that causes sooty stripe of Sorghum spp.**—*Phytopathology*, xxxvi, 3, pp. 190–200, 4 figs., 1946.

The morphology of the fungus responsible for sooty stripe of sorghum, Sudan grass, and Johnson grass (*Sorghum halepense*) in the southern States of the American Union is described and its taxonomy discussed. It resembles *Gloeocercospora sorghi* Bain & Edgerton [*R.A.M.*, xxii, p. 302 and below, p. 397] in the possession of sporodochia and sclerotia, but the same organism was named *Septorella sorghi* by Ellis & Everhart in 1903 (*J. Mycol.*, ix, p. 164) in the belief that the fruiting body was a pycnidium. In 1920 Miura established the genus *Ramulispora* and named the sorghum pathogen *R. andropogonis* (*Rep. Koshurei agric. Exp. Sta. S. Manchur. Ry Co.* 11, p. 43, 1920), and in 1932 the species was transferred to *Titaeospora* Bubak under the name of *T. andropogonis* (Miura) Tai [*R.A.M.* xii, p. 248]. The fructification of the sorghum fungus, however, is a sporodochium, and its spores are typically branched, so that it cannot be accommodated in *Titaeospora*, which forms true acervuli and is characterized by conidia with basal fusions. Since Miura's fungus agrees perfectly with that investigated by the writers, it is proposed to retain his generic name of *Ramulispora* but to transfer it as *R. sorghi* (Ell. & Ev.) Olive & Lefebvre n. comb. in an emended form to the Tuberculariaceae, thereby abolishing the subfamily Hyaloramulisporae of the Melanconiales.

The elongate-elliptical lesions produced by *R. sorghi* on the leaves of its hosts are straw-coloured in the centre, with prominent purple borders, and usually covered at maturity with numerous black sclerotia, 53 to 170 μ in diameter. In a humid atmosphere sporodochia emerge through the stomata and produce pale

pink, gelatinous masses of curved, individually hyaline, 3- to 8-septate conidia, 38 to 86·3 by 1·9 to 3 μ, generally furnished with two, sometimes one or three, non- to triseptate lateral branches, 5 to 53 by 1·1 to 2·5 μ. The organism overwinters by means of the sclerotia, which germinate and give rise to conidia in the spring.

R. sorghi develops very slowly on artificial media in the form of raised, tuberculate, black masses, on which the conidia appear in pale pink, gelatinous aggregates. Inside the agar medium the growth habit and sporulation of the fungus are typical of the Moniliaceae.

Greenhouse inoculations on several sorghum varieties, Sudan grass, and Johnson grass resulted in the development of the characteristic lesions and fructifications of *R. sorghi*.

HARVEY (E. M.) **Changes in Lemons during storage as affected by air circulation and ventilation.**—*Tech. Bull. U.S. Dep. Agric.* 908, 32 pp., 9 graphs, 1946.

From 1938 to 1941, Eureka lemons of Californian origin were studied to determine the physiological changes occurring over long periods of storage in relation to the rot caused by *Alternaria citri* [*R.A.M.*, xvii, p. 389], and the comparative effects of ventilation, air circulation, and still air on such changes and on the keeping quality of the fruits. Air circulation was found to occupy an intermediate position between ventilation and still air, generally nearer the latter, and cannot be recommended as an alternative to the conditions provided by commercial storage. The amount of carbon dioxide accumulating in commercial storage is insufficient to injure the lemons, but mould emanations and those of the fruits themselves may easily cause deleterious effects during protracted periods.

The percentage of green buttons and their rate of change from one colour category to another afford a practical means of predicting the maximum safe duration of storage for a given lot of lemons. The first external symptom of infection by *A. citri* seldom indicated decay in more than 1 per cent. of the fruits. When at least 2 per cent. showed outwardly signs of rot, the lot was considered to have reached 'decay break' or definite susceptibility to the fungus. Lemons picked in midwinter were the best for storage.

ADAMS (J. A.) & WHEELER (E. H.). **Rate of development of milky disease in Japanese Beetle populations.**—*J. econ. Ent.*, xxxix, 2, pp. 248–254, 1946.

Under the climatic conditions of southern New York State, satisfactory control of the Japanese beetle (*Popillia japonica*) in two years instead of four was experimentally shown to be feasible by raising the dosage of spore dust of its bacterial antagonist, *Bacillus popilliae* [*R.A.M.*, xxiv, p. 415], from the current light rate of 2 to 2,000 lb. per acre.

DRECHSLER (C.). **A new Hyphomycete parasitic on a species of nematode.**—*Phytopathology*, xxxvi, 3, pp. 212–217, 1 fig., 1946.

Four of the ten nematode-destroying Hyphomycetes described by the author in a paper published in 1941 [*R.A.M.*, xxi, p. 15], viz., *Acrostalagmus bactrosporus*, *A. obovatus*, *Cephalosporium balanoides*, and *Spicaria coccospora*, closely resemble the insect parasites assigned to the same genera, and similar affinities are characteristic of a fifth fungus, *A. zeosporus* n.sp., of which a full account is given. It developed profusely in maize meal agar plate cultures overgrown by the mycelium of *Pythium ultimum* and then planted with partially decayed crabgrass (*Digitaria sanguinalis*) refuse containing several species of nematodes, of which *Panagrolaimus subelongatus* was the only one attacked.

Barthelet (J.). **L'anthracnose des Agaves.** [**Agave anthracnose.**]—*Ann. Épiphyt.*, N.S., viii, 2, pp. 111–120, 3 pl., 1942. [Received April, 1946.]

The most important disease of agaves on the Côte d'Azur, France, is anthracnose, due to *Colletotrichum agaves* [*R.A.M.*, xxii, p. 90]. It was first reported from Marseilles in 1921, and has been observed by the author on a large number of *Agave americana* plants between Saint Raphäel and Mentone and further inland.

Light brown, slightly depressed leaf spots, 1 to 2 cm. in diameter, first appear. These are scarcely perceptible on dark-leaved species such as the sisal agave *A. rigida* [var. *sisalana*], but are conspicuous on the *variegata* types of *A. americana*. In severe attacks they spread and merge to occupy the whole width of the leaf. Both the spots and larger areas are surrounded by a light green halo and later become black. Round the lesions a zone of tissue not invaded by the mycelium turns brown and becomes crinkled longitudinally. Later, the centres of the spots become whitish and small protuberances develop in concentric circles on both leaf surfaces; these burst, and expose reddish-beige stromatic masses consisting of dense tufts of mycelium, 1 to 2 mm. wide and 1 mm. high, bearing conidia. The peripheral leaves are those most affected, the oldest sometimes forming a withered ring on the ground. Infection reduces the ornamental or fibre value of the agaves and may completely destroy the young suckers.

The intercellular, varicose hyphae measured 2 to 3 μ in diameter. This mycelium formed subepidermal stromata. The hyaline conidiophores measured 30 to 40 by 3 to 4 μ. The setae measured 90 to 100 by 5 μ, were brown at the base, and sometimes branched. The subcylindrical, hyaline conidia measured 28 to 35 by 6 to 7 μ. The pink colour was due to oil globules which filled the spores at maturity.

Hedgcock identified *C. agaves* (*Rep. Mo. bot. Gdn* 16, pp. 153–156, 3 pl., 1905) on material from Mexico, and *C. catenulatum*, a nearly related species, has been recorded on *A. angustifolia marginata* from British Guiana [*R.A.M.*, x, p. 341]. Other fungi producing anthracnose symptoms on agaves, which might be confused with those of *C. agaves*, are *Nectriella miltina*, forming large, clear, necrotic areas with dull red perithecia, *Coniothyrium concentricum* var. *agaves* which attacks the tips of the leaves and forms fructifications scarcely projecting from the epidermis and often has pycnidia [ibid., viii, p. 106], and *Leptosphaeria obtusispora* Speg. f. *agaves* Barth. observed by the author on *A. ferox*, where it forms large, irregular, roundish, yellow-green areas with white centres bearing numerous perithecia, and on *A. striata* where the dried leaf ends bear perithecia. This new form species has perithecia averaging 250 to 300 μ in diameter, asci measuring 105 to 110 by 11 to 13 μ, and containing eight yellowish-brown, 5-septate ascospores 24 to 26 by 6 to 7 μ. The fungus found by McDonald on sisal in Kenya [ibid., iv, p. 591] may be the same. Other organisms found by the author on agave comprise a *Sphaeropsis* on *A. polyacantha*, a *Phomopsis* on *A. coccinea*, *Stagonospora macrospora* on *A. americana*, and a *Pleospora*.

As regards control, fungicides cannot be recommended for sisal; copper sprays might be useful on ornamental species. The affected leaves should be removed and burnt, although this will not give complete control since fructifications remain on the leaf bases.

Wade (G. C.). **Botrytis corm rot of the Gladiolus—its cause and control.**—*Proc. roy. Soc. Vict.*, N.S., lvii, 1–2, pp. 81–123, 3 pl., 3 graphs, 1946.

Part of this work has already been described from another source [*R.A.M.*, xxiv, p. 373]. The causal organism is considered to be *Botrytis gladioli* [ibid., x, p. 274] of which the following description is given: mycelium white and fluffy, hyphae when young 4 to 6 μ and when mature 12 μ in diameter; sclerotia, developing after six days on potato dextrose agar, at first creamy then black, smooth; macroconidia abundant on the plant but not in culture; conidiophores brown, 12 to

14 μ diameter with cells averaging 170 to 290 μ in length; conidia ovoid, 13 to 18 (average 15) by 11 to 12 (12) μ, thus considerably smaller than those described by Klebahn [loc. cit.] but agreeing with those given by W. C. Moore [ibid., xix, p. 153] and B. O. Dodge and T. Laskaris [ibid., xx, p. 364]; microconidia spherical, 2 μ diameter, not observed on natural media but developed freely submerged in potato dextrose agar after one month; sporodochia olivaceous and penicillate. The fungus has an optimum temperature of 21° C. and a maximum of 30°. Light stimulates the production of conidia and sclerotia. Dextrose increased the rate of growth in the presence of vitamins; sodium nitrate also increased growth rate. Microchemical tests showed accumulations of starch in actively growing lesions but not in those where the disease has been arrested, in which case a suberized layer developed round the diseased tissue. Diseased corms contain an amber-yellow, water-soluble pigment which changes to vinaceous-rufous on addition of alkali.

Pathogenicity of *B. gladioli* was established by artificial infection through needle punctures and retro-culture. The disease has been detected in the field on *Gladiolus primulinus* and *G.* hybrids. It has been induced by inoculation in *G. colvillii* and *Ixia grandiflora.*

Davis (B. H.). **Guignardia rhodorae, the perfect stage of Phyllosticta maxima on Rhododendron.**—*Mycologia*, xxxviii, 1, pp. 40–51, 1 fig., 1946.

The occurrence in leaf-spotting lesions on *Rhododendron* spp. in New Jersey of the pycnidial, spermagonial, and perithecial states of a fungus referred to *Guignardia rhodorae* (Cooke) n. comb. is recorded. The reddish-brown lesions, with slightly darker margins, are usually marginal (ranging from 3 to 40 by 2 to 20 mm.), but may occur anywhere on the lamina (2 to 20 mm. in diameter). Cultures obtained from tissue plantings, pycnospores, and ascospores showed that all states belong to the same fungus and produced pycnidia, but not spermagonia or perithecia.

The pycnidial state has characters in common with *Phyllosticta maxima.* The black epi-, rarely hypophyllous pycnidia, 125 to 200 μ in diameter, produce ovoid to globose-elliptic (or piriform), hyaline, granular pycnospores, 11·5 to 17·5 by 7·5 to 9·5 μ.

The spermagonia usually develop later than the pycnidia. They are small, black, from 60 to 125 μ in diameter, and bear long, narrow, dumb-bell-shaped, non-germinable spermatia 5 to 8·5 by 1 to 1·5 μ; under moist conditions these emerge as an amber-coloured drop at the ostiole. These characters are comparable with those of *P. saccardoi.*

The perithecia are epiphyllous, globose to depressed-globose, immersed 125 to 200 μ in diameter, the asci fasciculate, clavate, with rounded tips and short stalks, 80 to 120 by 12·5 to 16 μ, with a thickened apex, and the ascospores sub-biseriate, broadly elliptical (sometimes sub-rhomboidal), 15 to 19 by 7·3 to 10·2 μ.

P. maxima is distinct from *P. rhododendri* and also from the fungus determined by Tengwall as *P. maxima* and regarded by him as the imperfect state of *Venturia rhododendri* [*R.A.M.*, iii, p. 721].

Severin (H. H. P.). **The susceptibility of perennial Delphiniums to six viruses.**—*Hilgardia*, xiv, 10, pp. 549–570, 2 figs., 1942. [Received February, 1946.]

Six studies are presented of the symptomatic and varietal reactions of perennial *Delphinium* to the following viruses [cf. next abstract]: tomato spotted wilt [*R.A.M.*, xvii, p. 52], common cucumber mosaic [loc. cit.], western cucumber mosaic [ibid., xx, p. 189], tobacco ring spot [ibid., viii, p. 139], tobacco mosaic, and beet curly top [ibid., xvi, p. 387].

Spotted wilt is the most serious disease of perennial *Delphinium* along the Californian seaboard and whole fields have been infected by it. Early symptoms vary and often recall those of *Delphinium* calico [ibid., xxii, p. 207]. Pale green,

circular, elliptical, or irregular areas occur on leaves experimentally infected with extract from calla (*Zantedeschia aethiopica*), and at times large, lemon-yellow patches spread into the leaf lobes and later develop single or double chlorotic rings. Green or chlorotic veinbanding may be seen in the yellow areas. Later symptoms are more stable in their occurrence. Black rings of various sizes and irregular formation surround chlorotic tissue, which turns black on the lower leaves; the blackening may extend over the lobes, setting up necrosis of the petioles and veins. The virus spreads up the plant and to new shoots which develop after the old stock has died.

Extensive experimental inoculation of *Delphinium* plants by the author with common and western cucumber mosaics, respectively, and a few with tobacco ring spot was always followed by systemic infection, but that recorded in the case of tobacco mosaic was local, and only the inoculated leaves showed disease symptoms. Throughout these detailed and carefully tabulated experiments, the occurrence of spotting or blotching, with yellowing of the leaves, usually leading successively to chlorosis and finally necrosis, were more or less constant symptoms. Experiments undertaken for scientists and commercial and private growers showed the Wrexham *Delphinium* to be immune from the curly-top virus transmitted by the leafhopper, *Eutettix tenellus*. It cannot, therefore, be considered to have any causal connexion with phyllody and virescence in *Delphinium*.

SEVERIN (H. H. P.). **Viroses of annual Larkspurs.**—*Hilgardia*, xiv, 10, pp. 585–594, 2 pl., 1942. [Received February, 1946.]

In a series of experiments annual larkspurs (*Delphinium*) were shown to be naturally infected with the viruses of California aster yellows, celery calico [*R.A.M.*, xxii, p. 207], and [beet] curly top; and while plants have not been found in central-coastal regions infected by western cucumber mosaic virus, 108 or 93·1 per cent. of 116 experimentally inoculated annual larkspur plants became infected. Some plants with black leaves suggesting infection by the tomato spotted wilt virus have been found.

The first symptom of aster yellows was a chlorosis of the stem and flower stalk followed by a yellowing of the foliage. Drops of clear sap sometimes exuded from the petioles and stems of experimentally infected annual larkspurs, later turning brown and forming, both in artificially and naturally infected plants, a characteristic crust. Phyllody and virescence, similar to conditions described in a previous paper [loc. cit.], were noted. The virus was successfully transferred from naturally infected larkspurs to asters and celery by leafhoppers.

Extract from larkspurs transferred by mechanical inoculation caused symptoms of celery calico in celery, Turkish tobacco, and White Spine cucumbers. This virus causes in larkspur leaves yellowing in which small green areas are embedded.

Beet curly-top virus in larkspurs caused stunting, apical leaf-bunching, and downward curling of the lower and intermediate leaves. The virus was transferred from naturally infected larkspurs to sugar beet by means of the beet leafhopper [*Eutettix tenellus*].

Symptoms of western cucumber mosaic, difficult to detect in larkspurs with the naked eye, appear under the binocular microscope as a mottling of chlorotic areas which later coalesce to form streaks. In severe cases stunting and leaf-bunching occur.

JOHNSON (E. M.). **Two legume viruses transmissible to Tobacco.**—*Phytopathology*, xxxvi, 2, pp. 142–147, 3 figs., 1946.

Isolated lucerne plants bearing a few irregular, often indistinct, chlorotic blotches on an otherwise normal leaflet have been observed in a few Kentucky fields. The virus responsible for the condition is mechanically transmissible at greenhouse

temperatures in spring and autumn only to Kentucky 101 red clover, white clover, Dwarf Telephone peas, Stringless Green Refugee beans (*Phaseolus vulgaris*), June Pink and Marglobe tomatoes (also by grafting), Pompom *Zinnia* [*elegans*], Long Green cucumber (also by means of *Cuscuta* sp.) [*R.A.M.*, xxiv, p. 136], *Phytolacca americana*, and California Wonder [chilli] pepper. It was transmissible from diseased to healthy Grimm lucerne plants exclusively by aphids. On lucerne, the clovers, peas, tobacco, cucumber, and chilli the symptoms consisted of systemic mottling, accompanied in peas by stem and petiole necrotic streaks, dwarfing, and distortion; in tobacco and chilli by necrotic or chlorotic ring- and line-patterns, dwarfing and distortion, and in cucumber by chlorotic or necrotic spots on the rubbed leaves, dwarfing, and distortion. Beans, tomatoes, *Z. elegans*, and *P. decandra* reacted by the development of foliar necroses, accompanied in tomatoes and *A. elegans* by dwarfing and distortion, the former also showing necrotic streaks on the stems and petioles.

Sporadic infection of white clover (*Trifolium repens*) has also been observed, some of the leaves of diseased plants bearing irregular, pale yellow, mottled interveinal lesions. The virus is transmissible by rubbing to healthy plants of red clover, peas, beans, and tobacco, all of which respond by systemic mottling accompanied in peas by stem and petiole necrotic streaks, dwarfing, and distortion, in beans by foliar necroses, and in tobacco by dwarfing, distortion, and necrotic or chlorotic line patterns.

Both viruses withstood dilution to 1 in 100 but not to 1 in 500 and desiccation at room temperature for 15 but not for 30 days; the lucerne virus was inactivated by ten minutes' exposure to a temperature of 60°, while that of white clover succumbed at 58°, and the former resisted 72 but not 96 hours' ageing *in vitro* at room temperature and the latter 96 but not 120.

Notwithstanding their differential host ranges, the similarity of the symptoms induced by the two viruses on tobacco, peas, and red clover, and of their physical properties, points to their identification as strains of a single virus, probably that of lucerne mosaic [ibid., xv, p. 274].

KEIL (H. L.) & HOWARD (F. L.). **Previewing new materials for the control of turf diseases.**—*Greenk. Reptr*, xiv, 2, pp. 22, 34, 1946.

Every year over 100 specially synthesized chemical products are tested in the laboratory and in replicated field plots at the Rhode Island Agricultural Experiment Station for their fungicidal efficiency under all weather conditions and toxicity to plants. To date, the most promising compounds for the control of large brown patch (*Corticium vagum*) [*C. solani*] on creeping bent [*Agrostis stolonifera*] and other turf grasses [*R.A.M.*, xxiv, p. 232] are zerlate [zinc dimethyl dithiocarbamate: see below, p. 415], puraturf, thiosan (now known as tersan), and calo-clor; the last-named, however, may cause considerable burning in hot weather. Tersan, puraturf, and calo-clor are the most effective preventives of dollar spot (*Sclerotinia homoeocarpa*), while the incidence of copper spot (*Gloeocercospora* [*Ramulispora*] *sorghi*) [see above, p. 392] was reduced from 24 to less than 1 per cent. by puratized 177 and puraturf and 63 per cent. by zerlate 40 days after treatment, the corresponding figures at two months being 6, 1, and 15 per cent., respectively.

TROTTER (A.). **La 'nebbia' del Carrubo nella Sicilia meridionale (Oidium ceratoniae Comes).** [Carob mildew in southern Sicily (*Oidium ceratoniae* Comes).]—*Ric. Ossvz. Divulg. fitopat. Campania ed Mezzogiorno* (*Portici*), ix, pp. 1–16, 1 pl., 1 fig., 1942. [Received April, 1946.]

In view of the annual recurrence in the Ragusa province of Sicily of mildew (*Oidium ceratoniae*) of carob trees [*Ceratonia siliqua*] the author gives a more detailed account of a severe outbreak in 1927 [*R.A.M.*, vii, p. 557]. Although three

organisms, *O. ceratoniae*, *Pestalozzia curta*, and a *Phyllosticta* species [? *P. ceratoniae*] were associated with the leaf spots characteristic of the disease, the author considers that it was clearly due to the first-named fungus, as was shown by fresh infections. It is considered, however, that the local soil, climatic, and cultural conditions were predisposing factors, especially as carob trees in the other parts of the island appear to be immune from mildew.

DAINES (R. H.) & HOPPERSTEAD (S. L.). **Experiments with new organic fungicides for the control of Apple scab and Brooks' fruit spot (Phoma pomi).**—*Phytopathology*, xxxvi, 3, pp. 236–237, 1946.

Comparative apple-scab [*Venturia inaequalis*] control experiments were carried out in 1944 on the Red Delicious and Rome varieties in Delaware and on the latter only in New Jersey. In the Delaware series, U.S.R. No. 604 (2,3-dichloro-1,4-naphthoquinone) [see above, p. 390] at 1 and 1½ lb. per 100 gals. and puratized N5-X (phenyl mercuri triethanol ammonium lactate) [*R.A.M.*, xxiv, p. 327 *et passim*] at 1 in 1,000 and 1 in 2,000 were equally effective with lime-sulphur (1½ gals. per 100 gals. water) in combating scab. Fermate 1½ and 2 lb. per 100 gals., the same at ½ lb. plus half the recommended quantity of micronized sulphur, No. 604 at ¾ lb. or at ⅜ lb. plus zinc sulphate-lime (½ : ¼), and isothan Q 15 (lauryl isoquinolinum bromide) [loc. cit.] were comparable to the standard wettable sulphurs in affording protection from the pathogen. He 175 (disodium diethylene bisdithiocarbamate) [also known as dithane], 0·5 to 1·8 lb. per 100 gals., either alone or in combination with zinc sulphate-lime, failed to confer adequate protection against scab.

Similar results were obtained in New Jersey, except that No. 604 at 1 lb. and isothan Q 15 fell to slightly below the efficiency of a wettable sulphur.

In a test on Rome trees in Delaware to compare the relative eradicant values of puratized N5-X and lime-sulphur, the former at 1 in 1,000 and 1 in 2,000 was at least equally effective in this respect with the latter, the incidence of infection on the fruits in the puratized N5-X, lime-sulphur, and unsprayed plots being 9·5 and 10·5, 17, and 97 per cent., respectively.

In three years' experiments in New Jersey on Staymans, tetramethyl thiuram-disulphide (thiosan) at ¾ lb. per 100 gals., fermate at ¾ lb., and lead dimethyl dithiocarbamate at ¾ lb. gave excellent control of *Phoma pomi* [ibid., xvii, p. 465], when applied 17, 27, and 37 days after petal-fall. In one out of the three years (1943), a combination of fermate and lime in the early cover-spray period was more productive of russeting than was the former material alone. Oil used in conjunction with No. 604 caused excessive injury, but its addition to puratized N5-X, isothan Q 15, and He 175 in 1945 did not increase the damage to foliage or fruits. Rome apples in Delaware also suffered severely from a mixture of No. 604 and oil.

BARTHELET (J.). **Recherches sur quelques parasites des arbres fruitiers.** [Researches on some parasites of fruit trees.]—*Ann. Épiphyt.*, N.S., ix, 1, pp. 27–45, 12 figs., 1943. [Received April, 1946.]

During 1937, the author received samples of Reinette du Canada apples from the Pyrénées-Orientales showing infection by *Coryneum foliicolum* [*R.A.M.*, iii, p. 402; x, pp. 227, 676]. In October and December, 1940, the fungus was twice isolated from apples from the Ain on sale at Antibes and observed again in 1941 on apples from the Basses-Alpes which had become mummified as a result of insect attack. On fruits, the fungus would seem to be confined to rather cold, humid localities of medium elevation. Infected fruits usually show no outward lesion; internally a brown area surrounds the pericarp, as if over-ripe. This zone spreads towards the periphery, and when the remaining layer of healthy tissues becomes sufficiently thin, the fruit breaks under light pressure. At 16° C., this process takes

about 20 days. The lesion appears to arise at the point of insertion of the pedicel. Inoculations under the epidermis of fruits with fragments of a pure culture resulted in rapid infection at 20°.

Canker of pear branches of the Duchesse d'Angoulême and Beurré Giffard varieties due to *Phacidiella discolor* was noted in the same orchards where fruits had been affected in 1933 [ibid., xiii, p. 585; xvi, p. 690], in the vicinity of the Seine-et-Oise. The disease was also found near Suresnes and at Fontainebleau.

Spotted apples from the Val de Loire showed the presence of a *Diaporthe* which in culture gave pycnidia with spores, 7 to 9 by 2·5 to 3·5 μ, and later perithecia with necks 1·25 to 1·4 μ long, and numerous asci, 50 to 60 by 5 to 6 μ, with eight biseriate, two-celled ascospores, 12 to 13 by 3 μ.

Pears received in 1935 showed the presence of the fructifications of a fungus tentatively identified from pure cultures bearing two types of conidia as *Phomopsis mali* [*D. perniciosa*].

GUYOMARD (L.). **Sur le mode de contamination du Poirier par les conidies de Venturia pirina Aderhold.** [On the mode of contamination of the Pear by the conidia of *Venturia pirina* Aderhold.]—*C.R. Acad. Sci., Paris*, ccxx, 24, pp. 858–860, 1945.

The writer's observations in 1945 on 15 pear varieties in the Saint Brieuc region of Brittany revealed the presence of opening pustules of the scab fungus (*Venturia pirina*) on one-year-old Doyenne du Comice branches on 4th February. On the 25th pustules were detected containing both *V. pirina* conidia and conidiophore-bearing stromata of *Nectria ditissima* [*N. galligena*: *R.A.M.*, ii, p. 318]. Perithecia were recognized on 25th March on the dead over-wintered foliage, and the first discharge of ascospores occurred on 26th April.

The interest of these data in relation to local spraying practices is evident. G. Chalaud (*C. R. Congr. Pomme Bretagne*, p. 56, 1944) states that the apple scab (*V.* [*inaequalis*]) ascospore discharge period in Brittany extends from 1st to 10th May, and considers the first application of the spring spraying schedule (invariably subsequent to the latter date) to be fixed too late in the season. A similar criticism may now be made in respect of pear scab, an initial strong treatment against which should be given during the first week in February, followed by weaker applications to suppress the germinating conidia which play an important part in the pathogenesis of the disease.

SCHAD (C.). **Possibilité d'organiser un service d'avertissements contre la tavelure du Pommier et du Poirier.** [The possibility of organizing a spray-warning service against Apple and Pear scab.]—*Ann. Épiphyt.*, N.S., ix, 1, pp. 11–17, 1943. [Received April, 1946.]

After discussing, with numerous references to the relevant literature, the relation of weather conditions to perithecial development and maturity, ascospore liberation, conidial dissemination, and resultant infection by apple and pear scab [*Venturia inaequalis* and *V. pirina*, respectively], the author concludes that treatments must be based on a knowledge of ascospore spread, the technique employed for ascertaining the intensity of ascospore liberation, and the period when it is most likely to occur being described [see preceding abstract].

Young potted trees placed in the orchards during the infection period and then transferred to the greenhouse (at 17° to 18° C.) develop leaf scabs 8 to 15 days before the orchard trees. By this means infection can be judged in advance.

Because of the non-parallelism between perithecial maturity and apple and pear growth, the trees may be attacked at any time in different years between pre-bud-burst and the end of flowering. Hence, treatments based on the stages of development of the trees cannot, however numerous, ensure complete protection. As the ascospores and conidia are not widely dispersed, the most effective treatments

are those which afford protection against the first infections. In the absence of the 'blue' treatment [*R.A.M.*, xvii, p. 375], one or two applications of very alkaline (1 per cent.) Bordeaux mixture, timed according to ascospore emission, suffice to give adequate control.

It is recommended that the spray-warning service already organized in the central region should be extended.

ENGLISH (H.) & GERHARDT (F.). **The effect of ultraviolet radiation on the viability of fungus spores and on the development of decay in sweet Cherries.**—*Phytopathology*, xxxvi, 2, pp. 100–111, 1 fig., 1946.

The writers conducted experiments to ascertain the effect of ultra-violet radiation of wave-length 2,537 Å from 30-watt 'Uviarc' lamps on the spores of seven pathogens of Bing and Lambert sweet cherries in the State of Washington, namely *Alternaria* sp., *Botrytis cinerea, Cladosporium herbarum, Penicillium expansum, Pullularia* sp., *Rhizopus* sp., and *Sclerotinia fructicola* (*Monilia* stage), and on the development of decay in the fruits [*R.A.M.*, xxv, p. 124].

Treatment of spores sown on nutrient agar showed that most of those of *Penicillium expansum* succumbed to a 30-second exposure, whereas five minutes' irradiation destroyed only a few of the *Alternaria* conidia. Slightly over half the *Pullularia* and *S. fructicola* spores were killed in 2½ minutes, but a five-minute exposure was necessary to secure a comparable reduction in the viability of *C. herbarum* conidia. Attention has been drawn by previous workers to the greater resistance of dark spores to ultra-violet rays [ibid., viii, p. 516; xx, p. 219]. Colony formation by the surviving irradiated spores was noticeably retarded.

The viable spores in scrapings from the conveyor belt in a commercial sweet cherry packing plant were somewhat reduced by exposure to ultra-violet light, and it seems probable that a 45-minute treatment would kill the bulk of the inoculum; however, the number of living air-borne spores in an irradiated section of the packing room was not significantly smaller than that in a non-radiated part and it is thought that re-infection by air-borne spores would nullify any ray treatment.

Blue mould (*Penicillium expansum*) decay in artificially wounded and inoculated cherries was not reduced by irradiation, nor did the treatment arrest the process of natural rotting even when the exposure period was extended to ten minutes, or 40 times that employed commercially (25 seconds). As applied in these investigations, therefore, the ultra-violet light treatment seems to afford no prospect of combating decay in sweet cherries, whereas the maintenance of proper storage and transit temperatures definitely minimizes the losses from this source [ibid., xxi, p. 532].

BÖHNI (ERIKA). **Die Überwinterung des Erregers der Bitterfäule.** [The overwintering of the agent of bitter rot.]—*Experientia*, ii, 6, pp. 224–225, 4 figs., 1946. [English summary.]

Gloeosporium fructigenum [*Glomerella cingulata*], the agent of bitter rot of cherries, and more rarely of apples and plums in Switzerland, assumed an epidemic character in 1939, since when it has caused annual reductions in the cherry crop estimated at 50 to 70 per cent. The mycelium has been found to overwinter in a parasitic form in the bud scales, as well as in the twigs.

BUCHWALD (N. F.). **Paavisning af Monilinia (Sclerotinia) fructigena (Aderh. et Ruhl.) Honey paa Hasselnød (Corylus avellana).** [Confirmation of *Monilinia* (*Sclerotinia*) *fructigena* (Aderh. & Ruhl.) Honey on Hazel-Nut (*Corylus avellana*).]—*Tidsskr. Planteavl*, xlvii, 3, pp. 521–538, 5 figs., 1943. [English summary. Received June, 1946.]

The author's study of the *Sclerotinia* attacking hazel-nuts (*Corylus avellana*) in Denmark [*R.A.M.*, xvi, p. 86] and elsewhere was undertaken to settle the existing divergences of opinion regarding its specific identity [ibid., xxv, p. 36].

Victoria plums and Heynichs Zeller hazel-nuts, some picked and others still on the trees, were inoculated with the organisms from both hosts and developed identical symptoms. Mycelial and monospore isolates from the infected hazel-nut material corresponded in cultural characters with those of *S. fructigena* [ibid., xxiii, p. 136; xxiv, p. 157] and there were no differences in the dimensions of the conidia from the two hosts. In both cases identity with *S. fructigena* was established by calculations of the ratio between the mean length (approximately 20 μ) and breadth (10 μ), viz., 2 : 1, compared with 3 : 2 for *S. laxa* from plums. The host range of the former species, hitherto known only to comprise members of the Pomaceae and Amygdalaceae, is thus enlarged to include the hazel-nut.

Schellenberg's attribution of his hazel-nut pathogen to *S. coryli* (*Ber. dtsch. bot. Ges.*, xxiv, pp. 505–511, 1906) cannot be accepted in the light of subsequent studies, and the substitution of the name *Ciboria coryli* (Schellenb.) n. comb. [cf. *R.A.M.*, Suppl. 10, p. 135] is accordingly proposed.

JENNY (J.). **Die stationären Spritzanlagen.** [Stationary spraying outfits.]—*Schweiz. Z. Obst- u. Weinb.*, lv, 13, pp. 256–260, 2 figs., 1 diag., 1946.

Particulars are given of recent improvements in the construction, manipulation, and other features of Swiss spraying outfits for the orchard and vineyard [cf. *R.A.M.*, xxi, p. 183] necessitated by the intensification of plant-protective operations during recent years.

CARRIÈRE (E.). **Production of cuprous anticryptogamic mixtures from copper and its alloys.**—*Chim. et Industr.*, l, pp. 68–69, 1943. [French. Abs. in *Chem. Abstr.*, xl, 10, p. 2919, 1946.]

The most economical method of producing cuprous plant-protectives is said to have been found at the University of Montpellier, France, to consist in the electrolysis of sodium chloride solution (20 per cent.) by means of electrodes of copper or one of its alloys, e.g., brass, bronze, or German silver, with stirring of the electrolyte. Two copper electrodes are used, which are attacked alternately to obviate polarization. The process described yields products comparable to Bordeaux mixture [cf. next abstract], i.e., brass gives copper hydroxide and zinc hydroxide, bronze, copper hydroxide and stannous hydroxide, and German silver, copper hydroxide, stannous hydroxide, and nickel hydroxide.

CARRIÈRE (E.). **New outlooks for the anticryptogamic industry.**—*Chim. et Industr.*, lii, pp. 127–129, 1944. [French. Abs. in *Chem. Abstr.*, xl, 10, p. 2919, 1946.]

This is a discussion of changes demanded by modern practice in the plant-protective industry [see preceding abstract]. Copper hydroxide, already on the market under the name of 'Sandoz copper' [*R.A.M.*, xxiv, p. 153], containing a wetting agent to hold it in suspension, should be substituted for Bordeaux as the most economical form of copper. Aluminium oxide gel is an ideal adhesive for such products, with the added advantage of its own inherent toxicity. Alkali sulphur salts should replace elemental sulphur, which is very wasteful.

WELLMAN (R. H.) & MCCALLAN (S. E. A.). **Glyoxalidine derivatives as foliage fungicides. I. Laboratory studies.**—*Contr. Boyce Thompson Inst.*, xiv, 3, pp. 151–160, 2 graphs, 1946.

Laboratory tests [cf. next abstract] with derivatives of the glyoxalidine or imidazoline nucleus as fungicidal agents against *Sclerotinia fructicola*, *Glomerella cingulata*, *Alternaria solani*, and *Macrosporium sarcinaeforme* [*Stemphylium sarciniforme*], using the slide-germination method [*R.A.M.*, xxiii, pp. 34, 35] for determining the fungistatic LD_{50} values, showed that maximum fungistatic action is obtained with derivatives possessing a straight chain substituent containing 13 to 17 carbon atoms in the 2-position. Fungistatic action was not reduced by combination

with acid lead arsenate or summer oil. Maximum toxicity to plants using Bountiful beans (*Phaseolus vulgaris*), buckwheat, and tobacco in the greenhouse is attained with the 11- to 13-carbon atom derivatives. The ratio of highest non-phytotoxic concentration to LD_{50} value for 1-hydroxyethyl-2-undecylglyoxalidine is 13·5 and for 1-hydroxyethyl-2-heptadecylglyoxalidine 1450. Side-chain unsaturation increased phytotoxicity, as also does increasing length of chain in the 1-position. In the greenhouse these materials were harmful to tomatoes at concentrations too low to control early (*A. solani*) and late [*Phytophthora infestans*] blights, and gave only moderate control of snapdragon [*Antirrhinum majus*] rust [*Puccinia antirrhini*] without harm to the plants.

THURSTON (H. W.), HARRY (J. B.), LEWIS (F. H.), GROVES (A. B.), & TAYLOR (C. F.). **Glyoxalidine derivatives as foliage fungicides. II. Field studies.**—*Contr. Boyce Thompson Inst.*, xiv, 3, pp. 161–171, 1 fig., 1 graph, 1946.

The results are presented of field tests over several years for the control of black spot of rose (*Diplocarpon rosae*), apple scab (*Venturia inaequalis*) and rust (*Gymnosporangium juniperi-virginianae*), late blight of potato (*Phytophthora infestans*), and cherry leaf spot (*Coccomyces hiemalis*), with three glyoxalidine derivatives, already proved effective in laboratory tests [see preceding abstract], 1-hydroxyethyl-2-heptadecylglyoxalidine (No. 337), 2-heptadecylglyoxalidine (No. 341), and 1-aminoethyl-2-heptadecylglyoxalidine (No. 630). In one year's test on roses var. World's Fair, 337 and 341 at 3 lb. per 100 gals. gave control of blackspot equivalent to Bordeaux mixture with a wetting agent, the deposit being less conspicuous, although 337 was less effective and rather phytotoxic. In five years' tests of 337 and 630 at 3 lb. and 341 at 1 lb. per 100 gals. against apple scab, using varieties McIntosh and Stayman, control was obtained equivalent to standard lime-sulphur and considerably better than fermate at 3 lb. At 3 lb. per 100 gals. 337 proved phytotoxic, while at 1 lb. per 100 gals. 341 gave healthier foliage and a larger leaf area per fruit spur than standard lime-sulphur and the residual effect in controlling *V. inaequalis* on the foliage was considerable. Glyoxalidine derivatives have much steeper dosage response slopes than fermate in the field. Fermate gave better control of cedar-apple rust on varieties Rome and York than 337. Acid lead arsenate, nicotine sulphate, excess hydrated lime, and summer oil were found to be compatible in combination with the latter derivative. The glyoxalidine derivatives confirmed laboratory tests in their toxicity to potato leaves and failure to control *P. infestans*. In four years' tests in Pennsylvania and Virginia and two years' tests in West Virginia, 337 at 1 lb. per 100 gals. gave the best control of leaf-spot defoliation of sour cherries var. Montmorency and little or no leaf injury was caused and no dwarfing of the fruit.

STEWART (W. D.) & STANDEN (J. H.). **Polymeric organic polysulphides as fungicides and spray adjuvants.**—*Contr. Boyce Thompson Inst.*, xiv, 3, pp. 203–220, 3 figs., 1946.

Polyethylene pentasulphide is prepared cheaply by condensing ethylene dichloride and sodium pentasulphide using inexpensive raw materials, and is considered the most feasible, economically, of the organic polysulphides to produce commercially. These researches have solved some of the difficulties long experienced in producing for commercial use polymeric organic polysulphides of fine molecular particularity (ranging in the case of polyethylene pentasulphide to 1 to 4 μ), stability, adhesive power, and embodying, moreover, labile, active, sulphur atoms non-volatile in hot weather and, therefore, non-phytotoxic.

Dispersed on plants with a modern spray unit, fitted with a single gun, developing 350 to 400 lb. pressure, polyethylene pentasulphide forms stable, translucent latices which dehydrate to form rubber-like films, insoluble in water and oil, of

unusual tenacity and weather resistance, and these latter properties are imparted to the deposit of other spray materials with which it may be combined.

Slide-germination tests demonstrated that polymers of polyethylene polysulphides displayed almost equal toxicity to both *Sclerotinia fructicola* and *Alternaria solani* (fungicidal activity rising with increases in the sulphur content).

These experiments also showed that fungicidal activity is associated with the solid or polymer phase of the latices, the aqueous phase being almost non-toxic. Field experiments in 1945 with polyethylene pentasulphide showed that it gave good control at 2 lb. per 100 gals. of *Venturia inaequalis* in conditions of heavy and frequent rainfall; heavy scab infection in a 15-year-old orchard of Rome, McIntosh, Red Delicious, and Golden Delicious varieties was eliminated. Roses, which are highly susceptible to spray injury, were satisfactorily treated at 1 per cent. concentration of the fungicide for infection by *Sphaerotheca humuli* and slightly affected leaves regained their colour. Concentrations of 0·25 per cent. were sprayed on specified varieties of potato, tomato, eggplant, bean (*Phaseolus vulgaris*), beet, turnip, and onion in the field without damage to the plants.

The adhesive properties of polymeric organic polysulphides and the rubber-like properties of polymer are conjoined. The latices show excellent physical compatibility in combination with standard insecticides, fungicides, and spray adjuvants when tank-mixed, and increase their toxicity, but if added to dusts before wetting, or to alcoholic solutions and similar dehydrating agents before dilution, they lose their stability. Should slightly toxic materials be mixed with polyethylene polysulphide the latter's capacity to increase this phytotoxicity, by virtue of its high retentive power and resistance to removal by rain, might cause serious damage to plants, for example, were it used in combination with lead arsenate at 4 lb. per 100 gals. An unpublished paper by S. L. Hopperstead of the Plant Pathology Department of Delaware University records more effective control of *V. inaequalis* by Bordeaux mixture, isothan Q 15, and fermate used in association with polyethylene pentasulphide, the most satisfactory combination being with isothan Q 15. The polymer alone at 0·25 per cent. gave better control than fermate at one lb. per 100 gals. of water.

MARCHIONATTO (J. B.). **Reseña de la sanidad vegetal en la República Argentina.** [A review of plant health in the Argentine Republic.]—*Publ. Fac. Agron. B. Aires* 2, 117 pp., 19 figs., 2 diags., 1946. [English and Portuguese summaries.]

Many of the papers referred to in the course of this review of mycological and phytopathological developments in Argentina from the early years of the nineteenth century to 1943 have been noticed from the original sources. The past and present organization and functions of the plant health services under the Ministry of Agriculture are also described [*R.A.M.*, xv, p. 272; xxiv, p. 28].

SMOLÁK (J.). **Rostlinná Pathologie.** [Plant pathology.]—4th revised edition, 388 pp., 1 col. pl., 279 figs., Prague, Česká grafická Unie a.s., 1946. Za Kčs 100.

This fourth edition of the author's text-book on plant diseases, their prevention and control [*R.A.M.*, vi, p. 243], incorporates advances made in the various branches of phytopathology since 1926 and has particular value as supplying a modern text-book to students and workers at a time of agricultural reconstruction after the war. There is a bibliography of 101 titles and a full index.

DILLON WESTON (W. A. R.). **Bean rot. Powdery mildew of cereals. Apple scab.**—*J. Minist. Agric.*, lii, 9, pp. 425–426, 1 fig., 1945; 11, pp. 522–524, 1 fig.; 12, pp. 551–553, 1 fig., 1946.

These are popular accounts of bean rot (*Sclerotinia trifoliorum*), powdery mildew of wheat, barley, oats, rye, and grasses (*Erysiphe graminis*), and apple scab

(*Venturia inaequalis*), illustrated as in the earlier contributions [*R.A.M.*, xxiv, p. 105] by charts. Appropriate methods of control are indicated.

WOLFENBARGER (D. O.). **Dispersion of small organisms. Distance dispersion rates of bacteria, spores, seeds, pollen, and insects : incidence rates of diseases and injuries.**—*Amer. Midl. Nat.*, xxxv, 1, pp. 1–152, 181 graphs, 1946.

Following a brief introduction and discussion of terms and methods, the author in part I of this comprehensive treatise surveys the evidence available in the literature of dispersion and incidence rates for horizontal and vertical dispersions in the various groups of the animal and vegetable kingdoms as well as for such inanimate objects as splashes and balloons. Using methods described by Wadley and Wolfenbarger (*J. agric. Res.*, lxix, pp. 299–308, 1944), the data from published papers have been plotted as curves with distances from the source as abscissae and numbers or percentage increases as ordinates, such regression curves being used to compare the dispersions of the various fungi, bacteria, viruses, insects, etc., discussed.

Part II, comprising 24 pages and entitled generalizations, analyses the foregoing data, with deductions and recommendations for future trends of research, under the headings of distance, direction of dispersion, factors influencing dispersion, migration of small organisms, agencies or means of dispersion, density levels at the source, sampling characteristics, dispersions for control measures, considerations of vertical and horizontal dispersion, vertical dispersion generalizations, and vertical strata. Only a few of the points discussed can be noticed here. The distances dispersed by organisms depend on their character and activity. Field records show a remarkable consistency as regards rate of dispersion. Direction also depends on character and activity and is modified by locality. For spores [*R.A.M.*, xxiv, p. 374], even when wind-borne, dispersion appears to be omnidirectional, though this may hold for short distances only, long-distance dispersion being unidirectional. Factors both internal and external will affect not only distance and direction but also initiation and termination of dispersion activity. Density level at the source appears to determine the ultimate extent of spread even in the case of spores where active competition is not operative. Sampling characteristics show that methods should take into account, among other things, time and locus of origin, which may be centralized or non-centralized: in the latter case tangential as well as radial dispersion must be considered. These studies will aid control measures by providing essential information, e.g., the area over which control should extend to be effective and beyond which it would be unnecessary or uneconomical to continue it. Vertical distribution records show that while most dispersion occurs probably near the ground, *circa* 25 ft., bacteria and fungi have been found abundantly at 12,000 to 16,000 ft. With increased altitude factors affecting viability must be considered. An optimal dispersion stratum for each disseminule is considered possible. A nine-page bibliography is given.

WILSON (E. E.) & BAKER (G. A.). **Some aspects of the aerial dissemination of spores with special reference to conidia of Sclerotinia laxa.**—*J. agric. Res.*, lxxii, 9, pp. 301–327, 2 figs., 2 diags., 1 graph, 1946.

The increasing interest in the aerial dissemination of fungal spores [see preceding extract] is shown in this paper, which is fully tabulated and supplied with a list of 20 references to books and papers on various aspects of the subject.

The adaption of the conidia of *Sclerotinia laxa* [*R.A.M.*, xxi, p. 420] to wind dissemination was studied by measuring their rate of fall in still air from which it was calculated that if they were released at a height of 6 ft. they would be carried 3,770 ft. by a 5 m.p.h. wind before settling on the ground. In the Sacramento Valley large blocks of apricot trees, satisfactorily treated in January with mono-

calcium arsenite, were invariably infected abundantly by air-borne conidia from infected trees near by. The spread of disease northwards in these orchards by conidia from these sources was demonstrated by the figures for average incidence of blossom infection in trees 22, 44, 66, and 88 ft. from the nearest source trees which were in 1939, 39, 21, 12, and 6·5 per cent., respectively, of the level in source trees, and in 1940 55·5, 40, 28, and 23 per cent. It was noted that in both years there was only one period at the susceptible, blossoming stage when the direction of the wind favoured spore dissemination northwards from the source; but during this time the wind velocities in 1940 were 1·88 times higher than during the 1939 period.

To test the variation in aerial density of spores as distance from the source increased, *Lycopodium* spores were released and caught on glass slides placed 5, 10, and 15 ft. downwind from the point of release, the number of spores traversing a unit area of intercepting planes varying approximately in inverse proportion to the square of the distance from the source—a result to be expected if spore dispersion is described by a horizontal cone having its apex at the source of the spores and its base oriented to the average direction of the wind. The density of the spores was seen to be greatest in the centre of the plane at release level and decreased progressively above and below and to right and left of the centre, which also accords with normal probability. The degree of dispersion at various distances from the source was expressed, therefore, by taking the standard deviations of the distributions which increased in proportion to the distance from the source. The standard deviations for horizontal dispersions (designated as σ_h) were invariably greater than those for vertical dispersions (σ_v) at similar distances. A mean ratio of these two terms was found to be 1·55 when spores were discharged 7·5 ft. from the ground, corresponding closely to the figure of 1·59 recorded in measuring the amplitude of the horizontal and vertical components of turbulence with a bi-directional wind vane, placed 6·56 ft. from the ground. These results were confirmed by studies of dispersals of ammonium chloride 'smoke'.

Dispersal was found to be wider among leafless trees than in the open in the same wind. The wind velocity was decreased by the trees. Variations in wind velocity between 2 and 16 miles per hour did not appear to influence the rate at which aerial density of spores decreased with increasing distances from the source, but dispersion at a given distance from the source was often greater in the case of low-velocity winds than for those of medium and high velocity. Between medium and high velocities dispersion varied little within 5 to 15 ft.

The degree of dispersion at a given distance from the source depends on how fast the spores are dispersed in relation to the rate of their passage downwind. Indeed, with a limited source, spore dispersion at a given distance will probably decrease as wind velocity increases, unless the effects of turbulence on dispersion increase as fast as wind velocity, or faster. At present the general conclusion would appear to be that dispersion increases *pari passu* with velocity, except below about 5 m.p.h. The desirability of studying dispersal at greater distances from the source is indicated.

A generalization is attempted by comparing the spread of *S. laxa* with the results of these experiments for dispersal (1) from a three-dimensional block source instead of from a 'point' source, (2) through orchard trees instead of over open ground, and (3) for distances up to 100 instead of 15 ft. Disease dissemination through the apricot orchards is thought to be represented approximately by $y = \frac{A}{x^p}$ where y is the ratio of the percentage of blossom infection in a vertical section of susceptible (blossom) tissue at a horizontal distance from the source block to the percentage of blossom infection in the source trees, A and p are constants depending on wind velocity and possibly on other quantities to a lesser extent, and x is the horizontal distance from the centre of the nearest source trees.

CARVAJAL (F.). **A superior pith for free-hand sections.**—*Science*, N.S., ciii, 2665, p. 112, 1946.

Satisfactory results have been obtained with the dry pith of *Tetrapanax papyriferum* stalks in the sectioning of plant material. The pith is extractable from the dead stalks during the winter in rods of 1 m. or more in length and 1·5 cm. in diameter.

TAPKE (V. F.). **A rapid method for isolating single ascospores from apothecia.**—*Phytopathology*, xxxvi, 2, pp. 167–168, 1946.

A simple and rapid method for the isolation of single ascospores from apothecia consists in the immersion of the lower two-thirds of the apothecium in 95 per cent. alcohol, which causes the immediate ejection of a cloud of ascospores. Three Petri dishes containing nutrient agar are placed near the vial, which should exceed the fruiting body only slightly in height and diameter, and opened in the cloud in quick succession. The last plate usually catches only a few spores in perfect position for isolation and quite free from contaminants. Very small apothecia were held face downward over the nutrient agar and rubbed with a needle moistened with alcohol.

MCCALLAN (S. E. A.). **Outstanding diseases of agricultural crops and uses of fungicides in the United States.**—*Contr. Boyce Thompson Inst.*, xiv, 3, pp. 105–115, 1946.

A method is devised for assessing the national economic importance of losses from disease sustained by the main agricultural crops of the United States by means of an index obtained from the product of the logarithm of estimated annual loss per cent. (from *Plant Dis. Reptr Suppl.*, 1928–1939) and that of the farm value expressed in units of $100,000. The average losses for the ten-year period 1930–1939 were thus obtained and those with indices of 1 or more were regarded as outstanding diseases. The author points out that this method does not distinguish between diseases which are constantly present every year and those which are epiphytotic. Tables record the 50 leading crops, with the farm value, acreage, and farm value per acre, together with the five chief producing States; the 36 principal diseases ranked according to the index with the average annual percentage loss which they cause based on a decennial range of fluctuation, and the conventional measures for their control; and the annual cost of fungicidal chemicals and the percentage employed per crop in combating the main diseases. Maize root rot (*Diplodia zeae*), stalk rot (*Gibberella zeae*), and ear rot (*Fusarium moniliforme*) [*G. fujikuroi*], seedling blight and boll rot of cotton (*Glomerella gossypii*, *Fusarium* spp., *Rhizoctonia* [*Corticium*] *solani*, *Sclerotium bataticola* [*Macrophomina phaseoli*], *D. gossypina*, etc.), and apple scab (*Venturia inaequalis*) are most prominent among the diseases listed. Seed treatment as a method of control in maize diseases is thought likely to be limited to the seedling blight stage, but more efficient fungicides for seed treatment of maize and cotton and better and improved laboratory and greenhouse techniques for the speedy appraisal of such chemicals are clearly shown to be essential. A more thorough fruit and foliage fungicide or combined fungicide-insecticide is demanded for the control of *V. inaequalis*, and the greenhouse assessment method of Hamilton and Weaver (*Phytopathology*, xxx, 1, p. 7, 1940) requires further development for large-scale testing. A fungicide, or combination of sprays, to control diseases (notably *Phytophthora infestans*) and pests of potato is needed, although Bordeaux mixture will not be easily replaced; and mention is made of the author and Wellman's method [*R.A.M.*, xxiii, p. 34] for rapid testing of fungicides against this disease. Better seed treatments or wider use of existing ones seem desirable if the control of *Ustilago avenae* and *U. levis* [*U. kolleri*] is to become as effective as that of wheat bunt [*Tilletia caries* and *T. foetida*]. A better foliar fungicide is needed against brown rot (*Sclerotinia fructicola*) of peaches and

cherries, the most common organism used in the standard laboratory slide-germination method of testing fungicides [ibid., xxii, p. 489]. Fireblight (*Erwinia amylovora*), the most serious bacterial disease of pears and apples, still awaits more effective methods of control. Nor are copper sprays and dusts thoroughly satisfactory for the control of early (*Alternaria solani*) and *Septoria* (*S. lycopersici*) blights of tomato [ibid., xxiii, p. 34]. Better fungicides should improve the control of groundnut leaf spot [*Cercospora arachidicola* and *C. personata*] on which large quantities of sulphur are used. It is noted that chemical fungicides are unlikely, in the light of present knowledge, to control virus and vascular wilt diseases successfully.

It is considered that a fungicide assessment method evolved for one pathogen might well prove adaptable to a group of similar diseases. Thus, an effective control of tomato late blight [*P. infestans*] might be serviceable for other downy mildews and that of wheat bunt or the covered and loose smuts for all smuts arising from seedling infections.

NEERGAARD (P.). **Sprøjtning af Frugttræer, Frugtbuske, Køkkenurter og Blomster og anden Bekæmpelse af Havens Sygdomme og Skadedyr.** [Spraying of fruit trees, fruit bushes, kitchen-garden plants, and flowers, and other methods of combating garden diseases and pests.]—86 pp., 58 figs., Copenhagen, J. F. Clausens Forlag, 1944. [Received June, 1946.]

This second, greatly amplified edition of the author's practical guide to the direct and indirect control of horticultural diseases and pests in Denmark comprises an introductory chapter on the economics of treatment; an alphabetical list of hosts and their well-known pathogens; schedules for winter and summer spraying; lists of standard fungicides and insecticides and of the different types of apparatus with their uses; precautions against nicotine, arsenic, and copper poisoning; supplementary cultural measures, including the choice of resistant varieties, soil amendments, crop rotations, and the treatment of various mineral deficiencies, to which a key is supplied; virus diseases; hygiene; storage diseases of fruits and vegetables; references to useful literature; and a concluding note on the Danish advisory institutes and their functions.

CHILTON (S. J. P.), LUCAS (G. B.), & EDGERTON (C. W.). **Genetics of Glomerella. III. Crosses with a conidial strain.**—*Amer. J. Bot.*, xxxii, 9, pp. 549–554, 2 figs., 1 diag., 1946.

From crosses between a non-perithecia-producing conidial strain, previously called [*R.A.M.*, xxiii, p. 395] the heavy conidial strain derived from a plus strain of an unidentified species of *Glomerella* from *Ipomoea*, and strains of the plus and minus types, perithecia developed slowly in the crosses with the plus strain and more rapidly in those with the minus strains. Among the progeny derived from the ascospores from the crosses two additional conidial strains were obtained. The possible genetical make-up of the strains is deduced from the various crosses.

STICE (EDITH) & PRATT (R.). **Production of penicillin X in 'submerged' surface cultures.**—*Science*, N.S., ciii, 2678, pp. 535–537, 1 diag., 1 graph, 1946.

A description is given of the construction and application of an apparatus which permits a continuous production of penicillin X for several weeks without resterilization or reinoculation.

LIGGETT (R. W.). **The use of Corn steeping liquor in microbiological research.**—Abs. in *J. Bact.*, li, 5, p. 597, 1946.

Maize steeping liquor, a valuable nutritive material formerly known to the trade as 'yeast compound' and now used in penicillin fermentation [*R.A.M.*, xxv,

p. 352 and next abstracts], is an extract of maize solubles under acid conditions (P_H 4 to 4·5) in the presence of dilute sulphurous and lactic acids. Laboratory studies showed that during processing an active microbial population, chiefly lactic acid bacteria and yeasts, assists in the extraction. It contains roughly 8 per cent. nitrogen and is high in essential amino acids and minerals and most of the B-complex vitamins. Its value in antibiotic production is at least partially due to the extensive fermentation it has undergone during the wet maize milling process. In addition to its well-established property of augmenting yields in mould fermentations it is an effective medium for many bacteria.

PRATT (R.) & HOK (K. A.). **Influence of the proportions of KH_2 PO_4, Mg SO_4, and Na NO_3 in the nutrient solution on the production of penicillin in submerged cultures.**—*Amer. J. Bot.*, xxxiii, 3, pp. 149–156, 4 diags., 1 graph, 1946.

A study was made of the accumulation of penicillin in cultures of four strains of *Penicillium chrysogenum* and two of *P.* sp. grown in 65 different nutrient solutions each containing potassium dihydrogen phosphate, magnesium sulphate, and sodium nitrate in varying proportions but each with a total molar salt concentration of 0·04 M, with the addition of 3 per cent. lactose and 2 per cent. maize steep liquor [see preceding abstract]. In general, satisfactory penicillin yields were obtained from *P. chrysogenum* X 1612 with proportions of potassium sulphate and magnesium sulphate each ranging from 10 to 40 per cent. of the total salt concentration, the corresponding figure for sodium nitrate being 20 to 80 per cent. Adjustments in the total salt concentration showed that maximum yields of penicillin could be secured at 0·16 M with the standard proportions of auxiliary nutrients but alterations in these shifted the optimum salt strength.

FOSTER (J. W.), WOODRUFF (H. B.), & MCDANIEL (L. E.). **Microbiological aspects of penicillin. IV. Production of penicillin in submerged cultures of Penicillium notatum.**—*J. Bact.*, li, 4, pp. 465–478, 1 graph, 1946.

The growth of suitable strains of *Penicillium notatum* in shake culture results in the rapid formation of potent penicillin broths. This method of culture has several advantages over surface growth, including the elimination of such variable factors as diffusion and pellicle formation and the acceleration of development and metabolic processes. The growth of the mould on a modified brown sugar medium may be still further expedited by the addition of crude organic supplements, e.g., maize steep liquor (the reserve acidity of which should be adjusted with sodium hydroxide, calcium carbonate, or both) [see preceding abstracts] and cottonseed meal.

Penicillin production reaches a peak after the disappearance of the sugar from the medium. Evidence is forthcoming for the existence of two factors promoting penicillin formation, one inorganic ash and the other of an organic nature. Both reside in brown sugar, and the latter at least in cottonseed meal. The maintenance of an adequate oxygen supply is of paramount importance in penicillin production in submerged culture.

COOK (R. P.) & BROWN (MARGARET B.). **Penicillin production on juices from various parts of the Pea plant.**—Abs. in *Bio-chem. J.*, xl, 2, pp. xxii–xxiii, 1946.

The expressed juices from various parts of green seed pea plants were added to the basal medium used by the authors and collaborators in previous investigations on penicillin production by *Penicillium notatum.* The approximate maximum yields obtained from strain 1249B 21 were as follows: haulm juice 30 units per ml., pods 70, mixed haulm and pods 70, peas in pod (Kelvedon Wonder) 175, and the same ('V/C') 100.

Duyvené de Wit (J. J.), Jaarsveld (A[lida]), Jansen (B. C. P.), Van Luyk (A.), Luyken (R.), Oosterhuis (H. K.), & Wybrans (J. R.). **De isoleering van een bactericide en fungicide stof mit een penseelschimmel.** [The isolation of a bactericidal and fungicidal substance from a 'paint-brush' fungus.]—*Ned. Tijdschr. Geneesk.*, lxxxviii, 31–32, pp. 718–719, 1944. [Received July, 1946.]

As early as 1939 A. van Luyk drew attention to the great importance of the metabolic products of micro-organisms in medicine [*R.A.M.*, xix, p. 38]. Since that time a substance isolated from *Penicillium expansum* and named 'expansine' has been shown to inhibit the growth of human pathogenic bacteria, including *Eberthella typhosa* (inhibited at dilutions of 1 in 20 to 1 in 1,000) and *Mycobacterium tuberculosis* (at 1 in 20 to 1 in 200). The filtrate of *P. expansum* was found to contain at least two and probably more antibiotic fractions, of which one suppressed the development of *Pythium mamillatum*, the agent of sugar beet root rot [ibid., x, p. 293], in a dilution of 1 in 6,000,000 but was almost innocuous to *Staphylococcus aureus*, while the other inhibited the growth of the bacterium at 1 in 100,000 but did not prevent that of the fungus. Unlike penicillin, expansine is very poisonous, a daily dose of over 1 mg. being lethal to an adult rat.

Mathieson (J.). **Antibiotics from Victorian Basidiomycetes.**—*Aust. J. exp. Biol. med. Sci.*, xxiv, 1, pp. 57–59, 1946.

Out of 230 species of Basidiomycetes collected in Victoria and tested for their antibiotic properties, 39 were active against *Staphylococcus aureus*, one against *Escherichia* [*Bacterium*] *coli*, and 20 against both these organisms [cf. *R.A.M.*, xxiv, p. 158]. The aqueous extract of an unidentified species of *Psalliota* inhibited the growth of various bacteria, the diameters of the circles of inhibition in cylinder-plate tests with cultures of *Streptococcus pyogenes*, *Staphylococcus aureus*, *Bact. coli*, *Eberthella typhosa*, and *Shigella* Flexner III being 17, 16, 17, 29, and 16 mm., respectively, a 15-mm. ring being roughly equivalent to 0·4 Oxford units per ml. penicillin. The extract is not haemolytic after Seitz filtration, nor did it prove toxic on intracerebral injection into a mouse.

Musgrave (A. J.). **Mould growth on leather.**—*Chem. & Indust.*, *1946*, 24, pp. 226–227, 1946.

In this paper, read before the Microbiological Panel of the Food Group, Society of Chemical Industry, on 9th January, 1946, the author gives an outline of the mycological problems of the leather industry, supplemented by references to important contributions in the relevant literature.

Proposed provisional method for testing the resistance of leather to the growth of fungi.—*J. Amer. Leath. Chem. Ass.*, xl, 6, pp. 239–240, 1945.

The following are the essential features of the provisional method developed by the Physical Testing Committee of the American Leather Chemists' Association for testing the resistance of leather to fungal contamination. At least four representative specimens, not less than 1 sq. in. in area, shall be cut from each sample, and control specimens of a leather of established susceptibility to fungal invasion included in each series of tests. The inoculum shall consist of a fungus spore mixture in sand to be furnished by the Tanners' Council Laboratory, University of Cincinnati. Half the number of specimens are to be immersed for 5 to 10 minutes in distilled water (10 : 1 ratio water to leather by weight) and the remainder shaken for three hours in 20 times their weight of water, both processes at room temperature. After inoculation with a suspension of the spore mixture (10 gm. in 100 ml. water), the specimens shall be incubated for 30 days in a dark chamber at 25° to 32° C. and a relative humidity of not less than 85 per cent., and the report on the

test shall state that the leather either (*a*) showed no mould growth during the period of observation, or (*b*) the time at which fungal growth appeared, with conventional indications of its extent.

Kanagy (J. R.), Charles (Arbelia M.), Abrams (E.), & Tener (R. F.). **Effects of mildew on vegetable tanned strap leather.**—*J. Amer. Leath. Chem. Ass.*, xli, 5, pp. 198–213, 2 diags., 5 graphs, 1946.

Samples of vegetable-tanned strap leather were exposed to conditions favouring mildew growth in a tropical room at Fort Belvoir, Virginia, and also in soil-burial beds and in a humidity cabinet at the National Bureau of Standards, Washington, D.C. Moderate to heavy infection by *Aspergillus niger*, *A. oryzae*, *Penicillium* spp., and other organisms developed, resulting in increased stiffness, loss of tensile strength, decreased stretch at breaking-point, and weakening of the grain surface, but not in any appreciable deterioration of the hide substance. Chemical tests disclosed a loss of grease, water-solubles, glucose, tannins, and non-tannins, associated in the case of the first-named with fatty acid decomposition. Comparable samples, impregnated with a fungicidal oil having as active ingredients a mixture of paranitrophenol and pentachlorophenol in equal parts [*R.A.M.*, xxiii, p. 401] and stored under the same conditions as the untreated leather, showed no evidence of mildew after three months.

Weston (W. H.). **Tropical deterioration of textile products.**—*Proc. Conf. Quartermast. Text. Res., 1945*, pp. 29–39, 9 figs., 1945.

Much of the information presented in this survey of problems connected with the tropical deterioration of textiles [*R.A.M.*, xxiv, p. 427] has already been noticed from other sources. The following points may be noted. The loss of stores from mould and mildew in Ordnance Depots in India was estimated at £60,000 for the last three months of 1944 alone, a relatively dry period of the year. For determining the identity and nature of the organisms implicated in the process 137 samples of affected material, yielding a total of over 1,000 fungi, were received from 24 bases in the South and South-West Pacific theatres of war. The Quartermaster Corps (Army of the United States) maintains a collection of some 6,000 textile-destroying fungi. Cellulose-destroyers were represented in all groups; the vigour of this action is not necessarily an index of their importance, since some of the less destructive are highly important in the field because of their abundance and rapid growth. Evidence was obtained that the preliminary growth of one species of *Aspergillus* resulted in the more extensive growth later of one of the vigorous cellulose-destroyers.

Prevention and control has presented complex problems, the principal drawback to fungicidal agents being lack of resistance to rain and sunlight. Their evaluation by laboratory procedures requires checking from field tests, which takes considerable time to complete, and much of this work remains to be done. Exposure tests of treated fabrics to sunlight and to shade have been carried out chiefly in Florida and Panama. Work on fungicidal treatments is proceeding, but the development of immunity within the basic material itself, brought about by a chemical modification of the cellulosic system to render it unavailable as a carbon source of food, is regarded as a more promising field.

St. George (R. A.) & Furry (Margaret S.). **The resistance of treated Cotton fabrics to attack by termites and micro-organisms.**—*Amer. Dyest. Reptr*, xxxv, 8, pp. 207–210, 1 fig., 1946.

Of 16 finishing treatments tested by the soil-suspension method for their efficacy in the protection of cotton fabric against termite attack and fungal infection [*R.A.M.*, xxiii, p. 309], the following were eminently satisfactory for both purposes;

cuprammonium hydroxide (10 gm. per 100 ml. water), ten minutes' immersion, copper oleate [ibid., xxv, p. 355] (17 gm., five minutes), a mixture of copper naphthenate and copper oleate (12·7 : 4·3 gm., five minutes), mercuric chloride with 8-hydroxyquinoline (1 : 2 gm., 30 minutes), and copper naphthenate (17 gm., five minutes). The temperature of the bath was 25° to 30° C. for all the treatments except the mercuric chloride and 8-hydroxyquinoline, for which it was raised to 100° (90° to 95° for a second period of 15 minutes' immersion). Excellent control of microbial damage, with slight termite infestation, was further afforded by copper sulphate with 8-hydroxyquinoline (1 : 2 gm., 30 minutes in the first bath at 100° and 15 in the second at 90° to 95°), and two natural dye extracts, osage orange [*Toxylon pomiferum*] (5 gm.) and quercitron [*Quercus velutina*] (5 and 10 gm.), both used in conjunction with copper sulphate (1 gm.) and potassium dichromate (0·3 gm.), the immersion periods for all treatments being 16 to 18 hours in the first bath and 30 minutes in the second, both at 100°.

Mildew and rot resistance of textiles and effectiveness of textile fungicides. Tentative method (3rd revision—April 4, 1946).—*Amer. Dyest. Reptr*, xxxv, 11, pp. P 274–276, P 282, 1946.

The general purposes of these methods [*R.A.M.*, xxiv, p. 282] are (1) to determine the behaviour of textiles in respect of mildew, and (2) to evaluate the mildew preventives offered to the trade. Section I contains a description of the actual test procedures regarded as most easily reproducible and widely applicable; II presents suggested methods of application and interpretation of these procedures in testing both the initial mildew resistance of textiles and the permanence of the reaction; and III describes the application of these tests in determining the fungicidal potency of mildew-preventive compounds under uniform conditions and their permanence when applied to a standard fabric.

MacDougal (D. T.) & Dufrénoy (J.). **Criteria of nutritive relations of fungi and seed-plants in mycorrhizae.**—*Plant Physiol.*, xxi, 1, pp. 1–10, 1946.

The authors consider that the nutritive relations of plants anatomically engaged vary by minute gradations from destructive parasitism, through intermediate stages of unbalanced to stabilized symbiosis, to effects purely mechanical and incidental. Moreover, plants set free substances in the soil that may be toxic or beneficial to adjacent species. Terms such as facultative and obligate parasitism and commensalism are, therefore, without precise meaning. A major and a minor feature may be distinguished between two plants which are anatomically engaged, viz., (1) the origination, flow, and ultimate disposal of material, and (2) the alterations in tissue structure, cytological aberrations, and metabolic changes resulting from these processes. It is consequently evident that the nature of the association of two species is ultimately determinable only on cytological and cytochemical evidence, the value of the latter depending on the sequence of metabolic changes being sufficiently fully ascertained and clearly represented.

In orchid and pine mycorrhiza [*R.A.M.*, xxiv, p. 29] the main constituents of the protoplasm may be elaborated by the fungi and transferred to the cortex. The fate of the occupied host cell after translocation is a matter of the balance between agencies which activate hydrogen from such metabolites as sugar, and of those activating atmospheric oxygen, inducing changes in the oxygen which dispose it to accept hydrogen. This process is dependent upon dehydrogenases, comprising compounds of carbon, nitrogen, phosphorus, iron, and sulphur of high molecular weight, such as are represented by active groups of complex structure like sulphhydril (J. R. Routien & R. F. Dawson in *Amer. J. Bot.*, xx, pp. 440–451, 1943). The relationship becomes symbiotic or parasitic according to the nature of the reaction. Normal functioning of the dehydrogenases in aerobic respiration involves the

resumption of their original state by phenolic compounds through re-hydrogenation following the release of hydrogen to oxygen by the dehydrogenases, permitting hyphal ramification to continue; while as a result of the dispersal of the dehydrogenases further oxidation and polymerization of the quinoids into gummy tannin masses is promoted, with fixation of the available proteins; and the tannin formation inhibits further hyphal development. Cytochemical methods of analysis of nutritive relations of mycorrhizal elements are discussed with special reference to vital staining as a method for localizing major cell components and to fixation methods procuring immediate reactions parallel to metabolic reactions ensuing gradually after a decompensated respiration in living cells. The importance is emphasized of phosphorus in the metabolism of mycorrhiza. The well-known molybdenic reagent causes water-soluble phosphorus compounds, such as are released in the dispersion of the hydrogenases, to appear immediately as a blue phosphomolybdenic complex. Phosphorus more tenaciously bound up in the lipo-nucleoproteins is demonstrated several hours later. It is further stated that phosphorylated glycogen, and not glycogen, as suggested earlier in the literature, may be accepted as the source of the carbohydrates in mycorrhiza, taking the form of glucose and starch in the cortex. Attention is drawn to the influence of the plastids on phosphorus metabolism, the amyloplasts, for example, present in the cortex but not in the fungus, synthesizing starch from the phosphorylated carbohydrates derived from the mycorrhizal fungus or transferred from neighbouring elements, while nucleoproteids are developed in proteoplasts both in hyphae and cortex.

Genetic investigations suggested that the minute seeds of terrestrial orchids offer possibilities of constitutional modification which might have their origin in environmental influences, particularly in regard to substances derived from associated fungi entering the embryo at an early stage, special significance attaching to accelerated metabolism and the transfer of foreign nucleoproteids and phosphorus complexes. The principal mutations observed included loss of roots, reduction or total loss of photosynthetic mechanisms, and the acquisition of a capacity to mature seeds in the absence of photosynthesis.

SAPPA (F.). **Ricerche biologiche sul Tuber magnatum Pico. La germinazione delle spore e carratteri della micorriza.** [Biological researches on *Tuber magnatum* Pico. The germination of the spores and the characters of the mycorrhiza.]—*Nuovo G. bot. ital.*, N.S., xlvii, 1, pp. 155–198, 1 pl. (facing p. 246), 1 fig., 1940. [Received July, 1946.]

In a study of the biology of the truffle, *Tuber magnatum* [*R.A.M.*, xii, p. 485], the author obtained clear evidence of spore germination, not hitherto recorded for this fungus. When oak seedlings were placed in pots after the roots had been sprinkled with the powdered fungus and sand and the plants were kept in a greenhouse and then placed outdoors in a shady place, the pots being kept above soil-level and watered during the dry months, a mycorrhiza developed which enveloped the rootlets, and was of the ectoendotrophic type, with well-marked ectotrophism. Penetration of the hyphae in the intercellular parts of the cortical layers was observed. The hyphae were mostly 2·5 to 3 μ in diameter and were septate, forming a compact layer round the root. These hyphae showed no clamp-connexions and differed in this and other respects from those described by Mattirolo in 1887. Further work is in progress.

ROBERTS (CATHERINE). **The effect of iron and other factors on the production of pigment by the yeast Torulopsis pulcherrima.**—*Amer. J. Bot.*, xxxiii, 4, pp. 237–244, 12 figs., 1946.

Studies are presented on the effects of the amount of nutrient substance, light, temperature, oxygen, iron concentration, and acidity of the medium on the varia-

tion in pigmentation of 10 single-cell isolates of *Torulopsis pulcherrima* [cf. *R.A.M.*, xxv, p. 235].

HAWKER (L[ILIAN] E.) & CHAUDHURI (S. D.). **Growth and fruiting of certain Ascomycetous fungi as influenced by the nature and concentration of carbohydrate in the medium.**—*Ann. Bot., Lond.*, N.S., x, 38, pp. 185–194, 1 graph, 1946.

The effects of a range of concentrations from 0·5 to 10 per cent. of glucose, fructose, sucrose, maltose, starch, and lactose on the growth and fructification of *Podospora* sp., *Sordaria fimicola*, *Chaetomium cochliodes*, *Melanospora zamiae*, *Ceratostomella adiposa*, and *Pyronema confluens* were investigated by experimental methods generally similar to those described in previous papers dealing with *M. destruens* [*R.A.M.*, xvi, p. 199] (and *Ann. Bot., Lond.*, 1, pp. 325–344, 1936; ibid., N.S., iii, pp. 455–468, 1939). The fungi responded uniformly to glucose and fructose, i.e., mycelial growth increased parallel with rises in the sugar concentration up to the maximum, whereas fruiting reached a maximum at a low concentration, varying with the individual species, and then declined rapidly. Reactions to the more complex carbohydrates were of three types, namely, (1) similar to those observed in the case of the above-mentioned hexoses, (2) starvation growth at low concentrations and a slight increase in both growth and fruiting at higher concentrations, and (3) an intermediate response expressed by poor growth and sporulation at low concentrations, both improving steadily with increased carbohydrate supplies. In three of the organisms studied, viz., *Podospora* sp., *Chaetomium cochliodes*, and *Pyronema confluens*, the types of response to sucrose were correlated with the rate of inversion of the sugar and the quantity of invertase produced per unit weight of mycelium. Thus, on the 11th day after inoculation *P. confluens* had utilized practically all the sugar and the dry weight of its mycelium was 900 mg. per 100 c.c. medium, the corresponding figures for *C. cochliodes* being all but 0·66 per cent. sugar and 780 mg. mycelium and for *Podospora* sp. 1·67 per cent. and 115 mg., respectively. These differences in response may be partially, though not wholly, explicable by variations in the rate at which the individual species can break down complex carbohydrates to hexose.

MARSH (P. B.) & BOLLENBACHER (KATHARINA). **The vitamin requirements of Memnoniella and Stachybotrys.**—*Amer. J. Bot.*, xxxiii, 4, pp. 245–249, 3 figs., 1946.

Experiments to determine the vitamin requirements of six isolates of the cellulose-decomposing fungus, *Memnoniella*, and five of the related genus, *Stachybotrys* [*R.A.M.*, xxv, p. 367], showed all to require very small amounts of biotin for their growth, which was not influenced by 15 other vitamins used. A medium containing mineral salts, agar, and brown sugar also, yeast extract and maizemeal agar media, all of which contain natural biotin, proved satisfactory for growth and sporulation. Both fungi grew freely on unbleached cotton duck, thus denoting the presence of biotin in the fabric.

KÖHLER (E.) & PAUKŠENS (J.). **Solanum demissum L. als Testpflanze verschiedener Mosaikviren.** [*Solanum demissum* L. as an indicator plant for various mosaic viruses.]—*Züchter*, xvi, 1–3, pp. 8–11, 1 fig., 1944.

A lengthy search for an indicator plant in the differential diagnosis of potato virus A [*R.A.M.*, xxi, pp. 218, 469; xxv, p. 322] has culminated in the discovery of *Solanum demissum*, on which the virus induces highly distinctive symptoms. Primary infection on the mechanically inoculated leaves is expressed by blackish-brown, roughly circular, necrotic spots, sometimes accompanied by vein-stippling;

the secondary symptom of transient vein-clearing on the upper leaves is not invariably present. The only other viruses causing a similar type of infection are those of the tobacco-mosaic virus group, which are of no practical importance in potato cultivation. The symptoms induced on *S. demissum* by potato viruses X, Y, K [? potato leaf-rolling mosaic virus], potato aucuba mosaic virus, and tobacco ringspot virus are described.

Ark (P. A.). **Some laboratory and field data on ring-rot of Potatoes in California.**—*Amer. Potato J.*, xxiii, 4, pp. 170–180, 1946.

An intensive study of potato bacterial ring rot (*Phytomonas sepedonica*) [*Corynebacterium sepedonicum*: *R.A.M.*, xxv, p. 181] in California showed that the ooze test [ibid., xxv, p. 277] is of value as a preliminary to other confirmatory tests, such as gram-staining and inoculations. If the disease is known to have been present in the seed stock, and it is desired to clean up the stock as quickly as possible recourse can also be had to the incubation test. Short pieces cut off the stem end are placed in peat-moss and incubated at 28° C. for three weeks, when affected tubers will show symptoms of the condition. The clean ones alone are then used for propagation.

Disinfection studies showed that in disinfecting a contaminated cutting-knife it should, before dipping in the disinfectant, be wiped to ensure the removal of slime and tissue debris that might protect the bacteria from contact with the disinfectant. Bacterial slime was found to exert a marked influence on the effectiveness of various disinfectants, dreft (sodium lauryl sulphanate) [ibid., xxiii, p. 300], to cite one example, which is toxic to pure cultures of *C. sepedonicum* in nutrient broth at a concentration of 0·5 per cent., being rendered ineffective in the presence of untreated slime at one of 2·5 per cent.

In its early stages ring rot has no soft-rot phase. A light, creamy discoloration in and near the turgid tissues of the vascular ring of the stem end is, however, present, and when the diseased tissues become mealy, cracks develop at the apical end, and secondary organisms enter. After this, the amount of soft rot in a field increases. Experiments showed that soft rot can easily be induced in ring-rot potatoes by *Erwinia carotovora*, *E. phytophthora*, and *Pseudomonas fluorescens*, whereas on healthy tubers these organisms produced only insignificant decay. It is thought, therefore, that the soft-rot group of bacteria are primarily wound-followers devoid of invasive capacity. Ring rot-infected hills with soft-rot complications were observed much resembling blackleg and *E. phytophthora* was isolated from both tubers and haulms. Under Californian conditions, blackleg of potatoes can be due to a complex of *E. carotovora*, *E. phytophthora*, or *P. fluorescens* following some strong pathogen, such as *C. sepedonicum*.

Davidson (R. S.). **Ring-rot-like symptoms produced by soft-rot bacteria in Potato tubers.**—*Phytopathology*, xxxvi, 3, pp. 237–239, 1 fig., 1 diag., 1946.

Symptoms resembling those of bacterial ring rot (*Corynebacterium sepedonicum*) developed in potato tubers in Minnesota after heavy flooding at harvest time in 1944. Gram-negative bacteria of the soft rot (*Erwinia carotovora*) group were isolated from Cobbler and Bliss Triumph tubers stored for seven months, and from immature ones of the latter variety from Texas, after varying periods of experimental submersion in water held at constant temperatures. Vascular ring decay was found in Cobblers after 47 hours at 33° C., after 56 at 27°, after 72 at 24°, after 80 at 21°, and after 118 at 18°, while tubers submerged at 33° for 72 hours and at 27° for 118 were completely decayed. The Triumphs reacted similarly but were rather more susceptible. These observations indicate that the soft rot

bacteria may induce a condition simulating the ring rot due to *C. sepedonicum* under the conditions described.

BENNETT (F. T.). **Soft rot of Potatoes in 1945 crops.**—*J. Minist. Agric.*, liii, 2, pp. 56–58, 1946.

A widespread epidemic of soft rot in potatoes in the north of England, first observed in consignments of Scottish seed, and later found affecting English stored crops, most commonly and severely attacked Arran Pilot, Eclipse, Catriona, Arran Banner, and King Edward potatoes among 20 varieties affected. It was attributed as a result of laboratory investigations to incomplete or curtailed maturation due to the peculiar weather conditions of the autumn of 1945. From the slimy white rot characteristic of this infection, a soft-rotting organism of the *B[acterium] carotovorum* [*Erwinia carotovora*] type was isolated. Inoculations with pure cultures were not carried out but slices of diseased material applied to lesions on sound tubers arising from scabs, mechanical damage, and artificial wounds and incisions showed that infection was associated only with immature tubers, the earlier the lifting the greater the liability to attack. Lack of air, high temperature, moist atmosphere, and pressure favoured spread, and these conditions occurred in railway wagons, large storage heaps, and clamps made in wet weather or earthed too quickly, the disease having been contracted in the soil or soon after lifting.

The rot did not appear to affect sprouting. Sound tubers, selected from consignments or clamps, may be used satisfactorily for seed purposes provided that maturation has been completed. The killing of haulms by spraying, followed by the period required for the maturing of the tubers in the soil, will reduce blight [*Phytophthora infestans*] which predisposes the tubers to soft rot.

EDDINS (A. H.) & WEST (E.). **Sclerotium rot of Potato seed pieces.**—*Phytopathology*, xxxvi, 3, pp. 239–240, 1 fig., 1946.

The seed pieces of Sebago potatoes planted in very dry soil in a field near Hastings, Florida, after the removal of the winter cabbage crop, were attacked by *Sclerotium rolfsii* (in the vegetative stage only) in March, 1945. The seed germinated poorly and the tips of most of the sprouts shrivelled, died, and turned brown on emergence. About four out of every ten seed pieces examined a month after planting were affected, the white mycelium of the fungus being found in decayed holes. Rapid growth was made in a moist chamber, typical sclerotia of *S. rolfsii* being formed on one piece in five days. Inoculation tests on seed pieces in wet and dry soil resulted in complete destruction in the watered pots and small decayed areas in the unwatered. The mycelium of the fungus was present on the pieces removed from wet soil, one of which bore abundant sclerotia after a week in a moist chamber. Mycelium and sclerotia were also found in the soil and on inoculated pieces left in dry soil for a fortnight.

This is believed to be the first report of the spontaneous occurrence of *S. rolfsii* on seed pieces in the field, though the fungus is known as an agent of tuber rot throughout the southern States [*R.A.M.*, ii, p. 387; xxii, p. 494].

HEUBERGER (J. W.) & STEARNS (L. A.). **Compatibility of DDT and fungicides on Potatoes.**—*J. econ. Ent.*, xxxix, 2, pp. 267–268, 1946.

In trials at the Delaware Agricultural Experiment Station in 1944 and 1945, DDT [dichloro-diphenyl-trichloroethane] caused no injury to potato plants when applied against leafhoppers (*Empoasca fabae*), in conjunction with Bordeaux, compound A, zinc dimethyl dithiocarbamate (zerlate) [see above, p. 397], or disodium ethylene bisdithiocarbamate (dithane)+zinc sulphate-lime for the control of early blight (*Alternaria solani*), nor did it reduce the toxicity of the

fungicides to the pathogen. The plants receiving DDT, either alone or combined with a fungicide, were taller and broader, with larger leaflets, than those from which the insecticide was withheld.

Schaal (L. A.). **Seed and soil treatment for the control of Potato scab.**—*Amer. Potato J.*, xxiii, 4, pp. 163–170, 1946.

Experiments on the control of potato scab (*Actinomyces scabies*) [*R.A.M.*, xxv, p. 78] carried out in infected alkaline soil (an irrigated, fine sandy loam, of P_H 7·6) in northern Colorado on the Bliss Triumph variety are described.

Treatment of infected 'seed' with mercuric chloride 1 in 1,000 for 1½ hours significantly reduced the number of affected tubers but gave no corresponding decrease in the area scabbed. Soil treatments with mercuric chloride, sulphamic acid, sulphur, aluminium sulphate, and potassium iodide all failed to control infection.

Darpoux (H.). **Contribution à l'étude des maladies des plantes oléagineuses en France.** [A contribution to the study of the diseases of oleaginous plants in France.]—*Ann. Épiphyt.*, N.S., xi, 1–2, pp. 71–103, 31 figs., 1945.

An account is given of studies carried out in 1943–4 on diseases of oleaginous plants grown experimentally at Versailles. *Peronospora parasitica* was found on colza (*Brassica napus oleifera*), turnip, *Camelina sativa*, and white mustard (*Sinapis* [*B.*] *alba*). *B. rapa* var. *oleifera*, *B. rapa* var. *biennis*, colza, *C. sativa*, and black mustard (*S.* [*B.*] *nigra*) were severely attacked by *Oidium*, presumably *Erysiphe polygoni*, the conidial measurements on colza being 25 to 38 by 14 to 18 μ, and on *B. rapa* var. *oleifera* 26 to 40 by 11 to 17 μ. *B. rapa* and less frequently *C. sativa* showed infection by *Cystopus candidus* [*R.A.M.*, xxii, p. 53]. Turnip, colza, and *B. nigra* were affected by *Alternaria brassicae*; control was obtained by Bordeaux (1 in 100). Poppies (*Papaver somniferum* var. *nigrum*) were seriously attacked by *Pleospora papaveracea* [ibid., xvii, p. 655], a new record for France, by *Peronospora arborescens* [ibid., xxii, p. 112 and next abstract] slightly, and by *Oidium*, presumably *E. cichoracearum*, the conidia measuring 23 to 31 by 12 to 15 μ. Seed disinfection is recommended. Soy-beans were slightly attacked by an *Ascochyta* near to *A. pisi*, the spherical pycnidia of which showed a peridium 10 μ thick, measured about 150 μ in diameter, and contained numerous hyaline stylospores with a transverse septum and measuring 7 to 9 by 2 to 3 μ. Sunflowers were affected by *Puccinia helianthi* [ibid., xxii, p. 111], *Sphaerotheca* sp. (close to *S. fuliginea* [var. *humuli*]) and *Botrytis* sp. *Carthamus tinctorius* was badly attacked by *Puccinia carthami* [ibid., xxiii, p. 40] and by an *Oidium*, probably *E. cichoracearum* f. *carthami*, with conidia measuring 28 to 34 by 15 to 17 μ. A long rotation and seed disinfection are suggested as protective measures against rust.

A serious disease, apparently not before described, was found on *Lallemantia iberica*, an oleaginous plant originating in the Caucasus but also cultivated in Yugoslavia, Persia, America, and since 1942 in Germany. Infection appeared about 15th July, 1944, and rapidly killed off a high proportion of the plants. Brown spots 3 to 4 mm. in diameter, enlarging to 1·5 cm., showing concentric, alternately light and dark areas, developed on all the aerial parts, especially the leaves; when numerous they become confluent and caused partial or complete withering of the plant. The spores, borne on brown, 2- to 5-septate conidiophores measuring 56 to 84 by 5 to 6 μ, were dark chestnut, with 9 to 12 transverse and 0 to 7 longitudinal septa; they measured 72 to 90 by 14 to 19 μ, and had a 4- to 5-septate, hyaline appendage which measured 117 to 156 by 2 μ. The fungus, which appears to be an *Alternaria*, overwintered on diseased plant debris. Numerous conidia were found at the end of January on the seed calices. Perithecia of a *Pleospora* closely resembling *P. herbarum* developed during the winter on pieces of stem debris.

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Arnaud (G.). **La 'gale noire' ou 'galle verruqueuse' de la Pomme de terre.** ['Black scab' or 'warty gall' of Potato.]—*Ann. Épiphyt.*, N.S., viii, 2, pp. 89–98, 1942. [Received April, 1946.]

The only satisfactory method of arresting the spread of potato wart disease (*Synchytrium endobioticum*) in France [*R.A.M.*, xv, pp. 311, 601] is by the general use of resistant varieties. Intensive cultivation for seed-selection purposes should be carried out with such resistant varieties as Belle de Fontenay, Juli, Étoile du Léon, Ackersegen, Ostbote, Furore, and Parnassia. The same varieties should also be imported (with due care), together with Krebsfest, Kaiserkrone, Feuergold, Pepo, Sickingen, and Max Delbruck, which are not at present widely grown. These imported tubers should be planted in isolated localities suitable for selection work (e.g., mountainous areas), and after one year's rigorous sanitary control the produce should be dispatched to large propagation centres. The cultivation of susceptible varieties should be forbidden, beginning in those parts of France adjacent to the north and north-eastern frontiers, and then in other areas where foci of infection are known to exist or are discovered. Careful watch for infected tubers should be kept at harvest in localities near those known or suspected to be infected, and if the disease is found, the area should be declared a contaminated zone and special precautions taken.

Aiyar (S. P.). **The effects of phosphate deficiency on Rice.**—*Proc. Indian Acad. Sci.*, Sect. B, xxiii, 4, pp. 165–193, 2 pl., 7 graphs, 1946.

The low rice yields produced at the Kelington Seed Farm, Yedashe, Central Burma, having been attributed to phosphate deficiency, pot, field, and solution culture experiments were carried out to determine the effects of phosphorus starvation and phosphorus treatments on seedlings. Characteristic symptoms of the shortage of this element included general stunting, reduction in tillering, bunching of the leaves, a dark or blue-green tinge, and (in solution cultures) a lack of branching and remarkable elongation of the primary roots, which were deep reddish-brown in contrast to the white of fully manured plants. In the field the crop remained green at maturity. Satisfactory yield increases were obtained by the joint application of phosphorus and nitrogen, while the use of the former alone resulted in a more modest improvement. In the field the application of 2 cwt. of bone meal per acre is recommended.

Khristov (A.). Гжби причиняващи петносването на маковитѣ кутийки и плесеняването на тѣхнитѣ семена. [Fungi causing spots on the balls, and moulding the seed of Opium Poppy.]—*Спис. Земед. Опит. Инсти, България* [*J. agric. Exp. Stas Bulgaria*], xiii, 1/2, pp. 13–19, 4 figs., 1943. [English summary. Received December, 1945.]

An examination of opium poppy (*Papaver somniferum*) balls from three different areas in Bulgaria during the years 1926 to 1932 showed the following fungi

as causal agents of spotting and seed infection. *Peronospora arborescens* [*R.A.M.*, xxi, p. 99] under favourable conditions attacked poppy balls throughout the vegetation period, causing premature withering or abnormal development. *Pleospora calvescens* [ibid., xxiii, p. 120] annually causes more or less severe losses. In humid conditions the hyphae on the spots penetrate inward, causing moulding of the seed [ibid., xi, p. 475]. *Alternaria brassicae* var. *somniferum*, first noted in Bulgaria in 1909, has since been observed in the Sofia and other areas on *Papaver somniferum* and in the former on *P. orientale*. This semi-parasitic fungus primarily attacks poppy plants towards the end of the vegetation period, causing dry, irregular, yellow to greyish-brown spots, dark to pale yellow at the circumference. There have been cases where the fungus appeared early and caused considerable damage. The pathogenicity of the fungus was established by inoculations on plants at various stages of growth, the incubation period being six days, and the fungus was successfully reisolated. *Fusarium scirpi* var. *caudatum* [ibid., xii, p. 493], parasitic on the roots of sweet potato, has been reported as semi-parasitic on opium poppies in Bulgaria. Infected leaves displayed precocious growth, at first developing whitish-yellow, ill-defined spots, which sometimes became brown at the centre. On the stems the elongated spots were ill defined, light yellow to brown, occasionally turning to brown or dark brown. This fungus is frequently encountered under field conditions, causing spotting of poppy plants and moulding of their seed. The dry, rounded, yellow to greenish-brown spots frequently coalesce and embrace the whole upper part of the plant. Seed from infected plants sown in sterilized soil yielded stunted seedlings, which assumed a reddish-brown colour at the base. The fungus affects the hypocotyls and cotyledons, on which whitish-brown to brown spots appear. *Hormodendrum cladosporioides* [ibid., xviii, p. 84; xxi, p. 531], a form of *Mycosphaerella tulasnei*, with spores measuring 7·5 to 24 by 2·5 to 6·6 μ, usually uni-, rarely quadricellular, was isolated from poppy seeds, the lower leaves of plants grown from infected seed being attacked and becoming yellow-brown at the base. *Ophiobolus sativus* causes the formation on poppy leaves of small, dry, round to polygonal spots, grey at first, becoming brown to dark brown in the centre at maturity and finally surrounded by a dark, oily, brownish-green halo. The conidiophores measured 37 to 88·5 by 19·5 to 26·5 μ and were 3- to 8-septate, developing on characteristic markedly articulate conidiophores. In form, dimensions, septation, and variation, the *Helminthosporium* state was fully consonant with *H. sativum* and inoculations of barley with the poppy isolate gave positive results.

On rare occasions the following organisms showed limited pathogenicity to poppy plants: *Macrosporium bresadolae* [ibid., iv, p. 313], *Fusarium* sp., *Trichothecium roseum*, *Sclerotinia* sp., *Rhizopus* sp., *Penicillium* sp., and *Mucor mucedo*.

Control measures recommended are destruction of stubble of the former poppy crop, use of disease-free seed, seed disinfection with 0·05 per cent. mercuric chloride for one hour or 0·25 per cent. formaldehyde for 15 minutes, and spraying the plants, especially the balls, with 1 per cent. Bordeaux mixture and resin soap.

Cristinzio (M.). **Una grave malattia del Ricino (Ricinus communis L.) in Provincia di Napoli.** [A serious disease of Castor Oil (*Ricinus communis* L.) in the Province of Naples.]—*Ric. Ossvz. Divulg. fitopat. Campania ed Mezzogiorno* (*Portici*), ix, pp. 83–92, 2 pl., 1 fig., 1942. [Received April, 1946.]

During 1939, castor oil (*Ricinus communis*) growing in three localities near Naples showed the presence of a disease [*R.A.M.*, xvii, p. 135] which caused slight loss. In 1940 it became more prevalent, and in 1941 a high percentage of plants was killed off. The variety mainly affected was Minore, which had been grown on a large scale for many years; on the recently introduced Sanguigna the attack was less severe.

Blackish spots, with marked indentations, and extending frequently from the base of the stem to the tips of the branches, began above the collar and spread

upwards. Sometimes, only one branch was affected at first, though the others withered later as a result of parasitism localized in the stem. The diseased branches were contorted, bent over towards the ground, and bore few, small, chlorotic leaves with pinched inflorescences. Light red pustules or, in rainy weather, a white mycelial rot, later developed on the spots.

According to the growers, the disease appeared when the young plants showed only two or three leaves. Sowings made early in April showed on 13th June in some plantings, 30 per cent. of the plants already dead or withered. Early infections can prove fatal in only two or three days. From the symptoms of the disease and the microscopic characters of the mycelium and conidia the author attributes the disease to *Fusarium sambucinum* [*Gibberella pulicaris*: ibid., xviii, p. 760; xxv, p. 331]. Outbreaks were closely related with seasonal conditions, the nature of the soil, and cultural practices, assuming epidemic proportions after wet periods, whereas in dry weather they tended to disappear. If wet conditions recurred the plants again wilted and finally succumbed. The local soils and flood method of irrigation undoubtedly favour early infections. The disease was probably introduced into the Campagna on seed from northern Italy.

Control lies chiefly in prevention; the burning of infected plants, thin sowings without intercropping, improved irrigation methods, the use of healthy or treated seed, a two-years' rotation at least, the avoidance of excessive applications of organic fertilizers, chemical fertilizers, especially calcium cyanamide, being used, and the adoption of resistant varieties. In very wet seasons the young plants should be sprayed once or twice with 1 per cent. Bordeaux mixture or 2 per cent. calcium polysulphide.

CAMINHA (A.). **A enfermidade do mosaico na Baía.** [The mosaic disease in Bahia.]—*Brasil açuc.*, xxi, 6, pp. 67–72, 2 figs., 1943. [Received April, 1946.]

In the course of a tour of inspection of over 50 sugar-cane plantations in the State of Bahia, the author observed widespread infection by the mosaic virus, generally in a mild form which need cause no immediate alarm. Certain old varieties, however, such as Bois Rouge, Demerara 625, Salangor, Creoula, and Pitú, are highly susceptible and should be excluded from future plantings. Attention is drawn to the possibility of changes in the normal reactions to mosaic of varieties transplanted to a new habitat, cases in point including P.O.J. 213, which is susceptible in its place of origin and also in Pernambuco, Brazil, but virtually immune in Argentina, resistant in São Paulo, and tolerant in Rio; H. 709, absolutely immune in Hawaii, is extremely susceptible elsewhere; B.H. 10 (12), practically immune in Barbados and British Guiana, shows exaggerated susceptibility in Brazil; Cayenne 10, highly resistant in British Guiana, immediately develops tertiary symptoms of mosaic in Rio; the above-mentioned Demerara 615 is perfectly healthy in British Guiana and in Pernambuco and Alagoas, Brazil, but in Rio it has had to be discarded on account of its susceptibility to mosaic, and a similar course must be recommended for Bahia; and Coimbatore 281, highly susceptible in its native habitat, acquires a marked degree of resistance in São Paulo. Finally, a strict watch should be kept on the ordinarily resistant Co. 290, which occupies 70 per cent. of the total area under sugar-cane in Bahia and has shown disquieting signs of susceptibility. To guard against a possible collapse of this variety the cultivation of the highly resistant P.O.J. 2878 should be extended to cover at least 80 per cent. of the whole area.

CAMINHA (A.). **A molestia das listas vermelhas.** [The red-stripe disease.]—*Brasil açuc.*, xx, 5, pp. 507–509, 1 fig., 1942. [Received April, 1946.]

Red stripe of sugar-cane (*Phytomonas* [*Xanthomonas*] *rubrilineans* and *P. rubrisubalbicans*) [*R.A.M.*, x, p. 128] was first recorded in Brazil by the author at

Campos, State of Rio [ibid., xvi, p. 127], in 1931, and in the following year the loss from this source in some of the regional plantations amounted to 30 per cent. and upwards of the normal yield per ha. At the same time A. Müller confirmed the presence of the disease in Minas Gerais, and reports from Mato Grosso point to its existence in that State also. Besides the widely grown P.O.J. 2878 variety, P.O.J. 2714, 2725, 2727, 213, 228, and 36 are highly resistant to red stripe, while resistance or tolerance has been shown by P.O.J. 979 and 105, Co. 213, 281, and 290, Kassoer, and Uba. The cultivation of resistant varieties is the best and most economical method of combating red stripe. Roguing of infected stools may be practised with advantage in the early stages of the disease, but in cases of advanced contamination a bi- to triennial rotation with leguminous cover crops is recommended, suitable species including *Calopogonium mucunoides*, *Pueraria javanica*, *Indigofera hendecaphylla*, *I. hirsuta*, *Centrosema pubescens*, and *Crotalaria usaramoensis*.

Arruda (S. C.). **As doenças da Cana de Açucar no Estado de São Paulo.** [Sugar-Cane diseases in the State of São Paulo.]—*Biológico*, xi, 12, pp. 309–315, 4 figs., 1945; xii, 5, pp. 133–134, 3 figs., 2 diags., 1946.

The two most important sugar-cane diseases in São Paulo, Brazil [*R.A.M.*, xxv, p. 279], are leaf scald (*Phytomonas* [*Xanthomonas*] *albilineans*) and mosaic. Of the eight varieties cultivated on a commercial scale in the State, three are resistant to leaf scald, viz., C.P. 27/139, Co. 290, and F. 29/7, two tolerant, P.O.J. 2727 and P.O.J. 2878, and three susceptible, P.O.J. 213, Co. 281, and C.P. 29/320.

Both diseases may be combated by the same methods, i.e., the cultivation of resistant varieties and the production of healthy setts. Steps have already been taken to provide rigorously selected material of the resistant Co. 290 variety (which occupies over half the total area under sugar-cane in São Paulo) for propagation. Nurseries should be located at a distance from the ordinary cane fields, or if this is impracticable, in the vicinity of the mosaic-resistant varieties. Directions are given for the disinfection of the cut ends of the setts with a strong solution of creolin (against *X. albilineans*); for planting, which should be carried out from the middle of January to the middle of February, leaving a space of 30 to 50 cm. between each sett; and for the inspection service and roguing operations. Seven inspections should be made between May and November.

Observations were made in 1944–5 on the spread of mosaic in two regions, one pre-eminently adapted to cane-growing (Piracicaba) and the other unsuitable for this purpose (Campinas). In the former, where the widely grown, susceptible Co. 290 acts as a prolific reservoir of infection, the incidence of secondary infection ranged from 4·8 to 6·4 per cent. compared with only 0·8 to 1·2 in the latter.

Besides the immediate advantage of increased yields resulting from the selection of healthy setts, amounting to 14 per cent. in one test on Co. 290, the regular inspection service affords a safeguard against the dispersal of new diseases, which may be localized or even eradicated by timely control measures. A case in point is that of red stripe [*X. rubrilineans*: see preceding abstract], which was detected on only two stools out of 4,200 in a first-year nursery.

Pickel (B.). **O mal da raiz da Cana de Açucar.** [Sugar-Cane root rot.]—*Brasil Açuc.*, xxi, 1, pp. 94–100, 1943. [Received April, 1946.]

The writer summarizes the principal contributions to the literature of sugar-cane root rot and discusses the two theories that have been advanced to explain its etiology, viz., (1) root asphyxiation due to defective soil aeration, and (2) infection by parasitic fungi. Under Pernambuco conditions, the poor quality and unsuitable structure of the soil are the main factors in the development of root rot, but *Himantia stellifera* [*R.A.M.*, xxi, p. 246; xxv, p. 363] is responsible for considerable secondary damage. The disease is incurable and can only be combated by

prophylactic cultural methods designed to maintain the root system in a vigorous condition promoting rapid growth [ibid., xxv, p. 233].

BITANCOURT (A. A.). **A probit scale for slide rules.**—*Biometr. Bull.*, i, 4, pp. 46–47, 1 graph, 1945.

In studies of the frequency distribution of the length and width of different species of fungal spores, the writer has made extensive use of a modification of C. I. Bliss's graphic probit method, originally devised for the analysis of toxicological experiments (*Ann. appl. Biol.*, xxii, pp. 134–167, 1935; xxiv, pp. 815–852, 1937) involving, (1) measurement of the spore dimensions either with an ocular micrometer or by the application of a metric ruler to the projected image, the spore, or its photograph, (2) entry of the reading on a tally sheet to obtain a frequency distribution, (3) cumulation of the frequencies, (4) calculation of the percentage cumulated frequencies, and (5) conversion of percentages to probits by a table. Steps (4) and (5) were combined by the author into one operation with a slide rule carrying a probit scale.

WEHMEYER (L. E.). **Studies on some fungi from north-western Wyoming. I. Pyrenomycetes.**—*Mycologia*, xxxviii, 2, pp. 144–170, 20 figs., 1946.

Twenty-four species of Pyrenomycetes on stems of 70 different hosts, representing 115 collections made in seven localities of the Jackson region of the Rocky Mountains in 1940, are described.

As regards the genus *Mycosphaerella*, which has no obvious limitation of host, it is held that little practical value attaches to description on the basis of host occurrence. The writer has endeavoured, therefore, to marshal his material in such a way as to provide opportunity for later reference, rather than obscuring it under the names of new species or misdeterminations. In the first of two tables his collections are arranged according to spore size, and lines are employed to indicate probable species groups; and in the second many collections having certain common characters are similarly presented and referred to the collective species *M. tassiana*.

M. hypodermellae n. sp. was observed on the surface of living needles of *Pinus murrayana* as linear lesions of the epidermis, 100 to 300 μ in length, through which emerged a minute, granular stroma or a linear cluster of vertical setose hyphae. Globose perithecia, 90 to 100 μ in diameter, with walls of coarse, black parenchyma 25 to 35 μ thick, were scattered singly or in lines, embedded in the foliar tissue with their tiny, papillate ostioles emerging through a common rupture, often with a cluster of vertical, setose conidiophores 5 to 6 μ in diameter. The asci were dense and fasciculate, broadly clavate, 70 by 21 μ, elongating to 85 to 90 by 17 to 18 μ at maturity; the spores biseriate, clavate-ellipsoid, bicellular, colourless, the upper end rounded, and tapering towards the base, 13 to 16 by 3·5 to 5 μ.

This fungus occurred on older, rather discoloured needles infected by *Hypodermella concolor*. Dark-brown, septate hyphae abounded in the hysterothecia of *H. concolor* or immediately below the epidermis and formed small stromatic masses which gave rise to the vertical, densely septate, brown conidiophores, 5 to 7 μ in diameter and 85 to 100 μ long, of the *Scolecotrichum* stage. They bore brown, ellipsoid, bicellular conidia, measuring 17 to 18 by 7 μ long, deciduous and seldom seen attached. The ascus and conidial stages both resemble *M. tassiana*, but are more regularly clavate and the perithecia more globose, and embedded in longitudinal rows in this species. This collection resembles most *M. abietis*, of which Rostrup regarded *Phoma abietis* and *Toxosporium abietinum* as conidial stages. *M. peckii* on hemlock [*Tsuga*] cones, and *M. pinsapo* and *M. pinicola* on fir and pine needles, respectively, are similar but have smaller spores.

H. concolor produced scattered hysterothecia on the upper surface of the living parts of the previous year's leaves of *Pinus murrayana*, the tips of which were

brown and dry. This fungus is referred to *H. concolor* although the spore dimensions are smaller (40 to 44 by 2·5 to 3·5μ) than those given by Darker [*R.A.M.*, xii, p. 254]. Secondary fungi found on the same needle were a *Hendersonia* sp., apparently parasitic and similar to *H. acicola* [ibid., xvii, p. 570], the *M. hypodermellae* described above with *Scolecotrichum* (? its conidial stage), and tiny pycnidia of a *Ramularia*, the three last being considered as active pathogens of the hysterothecia of the *Hypodermella*.

Overholts (L. O.) & Lowe (J. L.). **New species of Poria.**—*Mycologia*, xxxviii, 2, pp. 202–212, 2 figs., 1946.

The following seven species of *Poria* producing decays in timbers are believed by the authors not to have been described before, and are accordingly proposed as new: *P. alutacea* Lowe on the wood of coniferous and deciduous trees, *P. carbonica* Overholts on dead and often charred wood of conifers, *P. fissiliformis* Pilát *in litt.* on the wood of deciduous trees, *P. illudens* Overholts & Lowe on the wood of conifers and, less often, deciduous trees, and *P. lenta* Overholts & Lowe, *P. mappa* Overholts & Lowe, and *P. rubens* Overholts & Lowe, all three on the wood of conifers.

Seaver (F. J.) & Waterston (J. M.). **Contributions to the mycoflora of Bermuda. IV.**—*Mycologia*, xxxviii, 2, pp. 180–201, 8 figs., 1946.

With this, the fourth contribution to the mycoflora of Bermuda [*R.A.M.*, xxii, p. 113], the number of named species recorded to date reaches a total of over 750, representing 310 genera. The number of endemic species is small and less than 7 per cent. of the total.

The present annotated list of 40 fungi includes *Macrophoma lilii* n. sp. on dead stems of *Lilium longiflorum*, and two other new species. Interesting fungi recorded include *Entomophthora virescens* parasitic on larvae of cutworms (*Feltia subterranea*) and *Claviceps paspali*, the finding of the sphacelial stage on the inflorescence of *Paspalum dilatatum* constituting a new record for the Islands.

Dodge (B. O.). **A curious fungus on Opuntia.**—*Bull. Torrey bot. Cl.*, lxxiii, 3, pp. 219–223, 2 figs., 1946.

Small fruiting bodies of a fungus found on the pads of the cactus *Opuntia ammophila* in Florida, and new to the author, are described as consisting of two parts, a stalk and a cap. The stalk is dark brown, about 200 to 500 μ in length, tapering from about 40 μ in diameter at the base to about 20 μ at the top, and is composed of up to ten easily separable joints. The dark-brown, almost black, caps, measuring 50 to 80 μ in diameter, 20 to 25 μ in thickness, and rather concavo-convex in shape, are easily dislodged and often come to rest on the cactus pads. The outer covering of the cap is chitinous, hard, and brittle, and appears perforated, but whether these scattered spots represent holes or only thin places is doubtful.

Pure cultures of the fungus were readily obtained from the cap. Unjointed stalks, a few with typical caps, growing from small aggregations of mycelium appeared after three or four weeks. The cap is considered to serve as an organ of propagation.

The fungus is named *Tretopileus opuntiae*, but its systematic position is not known.

Castellani (E.). **Osservazioni su casi di antibiosi tra Demaziacee ed un Uredinale.** [Observations on cases of antibiosis between Dematiaceae and a member of the Uredinales.]—Reprinted from *Riv. Pat. veg.*, xxxii, 7–8, 11 pp., 1 fig., 1942. [Received February, 1946.]

On leaves of *Rhus villosa* collected in Eritrea the author observed in many sori of *Hemileia rhois* an *Alternaria* displaying marked antibiotic action. The latter

fungus had completely invaded the rust spots, imparting to them a black, cottony appearance. On the lower leaf surface, from the rust spot emerged short conidiophores 5 to 7 μ wide, bearing chains of ellipsoidal, cylindrical, or obclavate conidia, beaked at one end, 16 to 25 μ long and 6 to 12 (average 10) μ wide, and usually with three transverse and one or two longitudinal septa. The development of the *Alternaria* was much more rapid and abundant than that of *H. rhois*, the sporophores of which it submerged as they appeared through the stomata. The effect was markedly unfavourable to the rust, the uredospores of which developed in smaller numbers and were less turgid than in the unattacked sori.

The *Alternaria* apparently belongs to the *A. tenuis* group. It cannot be regarded as a true hyperparasite. The mycelium penetrated the leaf tissues of *R. villosa*, and acting synergetically accelerated and increased the necrosis of the tissues begun by the rust, which had brought about the conditions necessary for infection by the *Alternaria*, a very weak parasite. The progress of *H. rhois*, an obligate parasite, was impeded or inhibited by a barrier of dead tissue round its own infection site, caused by the *Alternaria*.

The humid conditions prevailing at the time (over 90 per cent. humidity at certain hours) were more favourable to the development of saprophytes than of obligate parasites of plants.

Karling (J. S.). **Brazilian Chytrids. IX. Species of Rhizophydium.**—*Amer. J. Bot.*, xxxiii, 5, pp. 328–334, 37 figs., 1946.

This further study of the Brazilian Chytrids [*R.A.M.*, xxiv, p. 504] treats of twelve species of *Rhizophydium* recovered from water and moist soil samples obtained in the Amazon Valley. *R. hyperparasiticum* n. sp., *R. mycetophagum* n. sp., and *R. carpophilum* are hyperparasites of soil Chytrids, *Choanephora* sp., and Oomycetes, respectively; and *R. amoebae* n. sp. and *R. apiculatum* n. sp. of microscopic animals.

Johnson (E. M.) & Valleau (W. D.). **Field strains of Tobacco-mosaic virus.**—*Phytopathology*, xxxvi, 2, pp. 112–116, 1946.

Four necrotic-spotting (N'N') tobacco varieties [*R.A.M.*, xxii, p. 328], viz., Kelly Judy (Burley) and Kentucky 120 and 129, were inoculated in the field (except Ky. 120) with 49 dried samples of mosaic virus-infected tobacco collected over a period of 15 years, mostly in Kentucky (and including one strain from the 1882 crop), three from chilli, and two from *Physalis* sp. The symptoms induced by the different strains varied greatly both under greenhouse and field conditions, comprising all shades of mottling from pure white to dark green, different degrees of distortion, stunting, and burn, and several types and sizes of chlorotic and necrotic local spots. The symptoms on replicate plants were, however, identical. On a basis of similarity of symptoms and for convenience of tabulation, the collections were placed in a minimum of 19 greenhouse and 33 field groups.

Most of these tobacco mosaic virus collections, if studied on a non-necrotic spotting (n'n') variety like Kentucky 16, would have been referred to tobacco virus 1 or *Nicotiana* virus 1, as defined by J. Johnson [ibid., xvi, p. 480] and K. M. Smith [ibid., xvii, p. 52]. For this reason the authors deprecate the use of the terms 'tobacco virus 1', 'common field tobacco-mosaic virus', or 'wild type tobacco-mosaic virus' as indicative of specific entities.

Strong (M. C.). **The effects of soil moisture and temperature on Fusarium wilt of Tomato.**—*Phytopathology*, xxxvi, 3, pp. 218–225, 1 fig., 1 graph, 1946.

Ten years' field observations in Michigan on the relation of rainfall to the incidence of tomato wilt (*Fusarium*) [*bulbigenum* var. *lycopersici*] and greenhouse tests at constant soil-moisture and temperature levels indicate that the resistant

Marglobe and the susceptible John Baer variety respond in an opposite manner to the former factor [cf. *R.A.M.*, ii, pp. 428, 477; vi, p. 516; vii, p. 750]. Thus, Marglobe was more susceptible to infection at a soil-moisture level of 60 per cent. saturation than at 85 per cent., whereas in John Baer the relative positions were reversed. When soil-temperature conditions were kept constant and soil-moisture values changed during the tests, a reduction in the latter decreased the incidence of wilt in John Baer, while an increased supply of moisture raised it. Conversely, in Marglobe a rise in the soil-moisture content from 60 to 85 per cent. saturation reduced the amount of wilt, which was increased, on the other hand, by a fall in the moisture level.

Unlike soil-moisture alterations, those of the temperature levels did not elicit differing reactions from the two varieties, both of which were more susceptible to wilt at 28° C. than at 22°. With a constant soil-moisture level and a rise in soil temperature from 22° to 28°, the incidence of infection tended to increase in both varieties, whereas a fall in soil temperature from 28° to 22° did not affect the percentage of wilt developing.

GÄUMANN (E.) & JAAG (O.). **Über das Problem der Welkekrankheiten bei Pflanzen.** [On the problem of wilt diseases in plants.]—*Experientia*, ii, 6, pp. 215–220, 3 figs., 3 graphs, 1946. [English summary.]

'Lycomarasmin', a plasma toxin secreted by *Fusarium* [*bulbigenum* var.] *lycopersici*, the agent of tomato wilt [*R.A.M.*, xxv, p. 84], was experimentally shown to cause pathological wilting of tomato plants, usually accompanied by disturbance of the water balance, at dilutions of 10^{-2} and 10^{-3} M; at 10^{-4} M only the latter symptom was observed. These results are explained on the theory that the semipermeability of the plasma membranes is completely destroyed by the higher concentrations of the toxin, whereas at a lower one only the permeability of the exterior plasma boundary layer for water is affected.

WALKER (J. C.) & FOSTER (R. E.). **Plant nutrition in relation to disease development. III. Fusarium wilt of Tomato.**—*Amer. J. Bot.*, xxxiii, 4, pp. 259–264, 3 graphs, 1946.

Studies are presented of the relation of nutrient salt concentration and nutrient ion balance to *Fusarium* wilt of tomato by methods similar to those reported by the senior author and W. J. Hooker for cabbage yellows (*Fusarium conglutinans*) and club root [*R.A.M.*, xxiv, p. 484; xxv, p. 148]. Two-week-old plants of the Bonny Best, Marglobe, Master Marglobe, and Red Currant varieties were used, the first being the most susceptible, while Red Currant developed no disease. Growth of the fungus, that of the young host plants, and wilt development have approximately the same optimum temperature and the plants were grown at this temperature. The fungus used was a virulent strain of *F. oxysporum* [*F. bulbigenum*] f. *lycopersici*.

Increases of salt concentration from 0·1 to 1 of Hoagland and Snyder's solution (*Proc. Amer. Soc. hort. Sci.*, xxx, pp. 288–294, 1933) were accompanied by a notable slowing-up in the rate of disease incidence, which slowed still more when the concentration was doubled; but when the concentration was trebled it increased again slightly. Thus, the greatest rate of disease incidence occurred at the weakest concentration when the growth of both the host and pathogen is reduced, that of the host to a greater degree. Low potassium or high nitrogen at the same osmotic pressure stimulated the activity of the disease, and high potassium or low nitrogen diminished it.

While the response to these experiments was similar to that noted in cabbage yellows, the manner in which it takes effect cannot yet be explained. Values for diffusion pressure deficit of healthy plants on the one hand, and disease

development on the other, offered an approximately negative correlation in the nutrient concentration series.

When the same strain of the pathogen was used, the disease expression of the intermediate resistant varieties followed the same curve in relation to salt concentration as the susceptible varieties, but always at lower values. When single-gene high resistance was present in the host no disease was observed at any extreme of nutrient concentration or balance. This suggests that in the field single-gene resistance should be more satisfactory than multiple-gene resistance. In the same nutrient concentrations the disease developed more rapidly in an intermediate resistant variety exposed to a virulent strain of the pathogen than in the susceptible variety exposed to a mild strain. Wilt, whether induced by the mild or the virulent strain, has the same relation to nutrition even though there is a difference in total disease development during a given period.

Berger (G.). **Une bactériose de la Tomate nouvellement observée au Maroc (Phytomonas michiganensis [E. F. Smith] Bergey et al.)** [A bacterial disease of Tomato newly observed in Morocco (*Phytomonas michiganensis* [E. F. Smith] Bergey et al.).]—*Ann. Épiphyt.*, N.S., viii, 2, pp. 177–187, 7 figs., 1942. [Received April, 1946.]

In May, 1937, a few tomato fruits in a market garden at Chaouia, Morocco, were found to be affected by *Phytomonas michiganensis* [*Corynebacterium michiganense*: *R.A.M.*, xxiii, p. 475; xxiv, p. 352], not previously recorded in North Africa. The disease was no longer present in the following spring. Cultures maintained at the Casablanca laboratory for a year on potato and on milk produced white spots in three days on [tomato] fruits sprinkled with them. Inoculations on to unwounded surfaces of the fruits gave as rapid and as good infections as when prick inoculations were made. Sprinkling the roots of young tomato plants with a suspension of the bacteria at transplanting invariably gave positive results; after 12 to 15 days growth became retarded, the plants yellowed, the leaves wilted, and after a month most of the plants were dead. Wound inoculations made by pinching the leaves or buds and adding bacteria gave the same results, but more slowly, as did prick inoculations in, or deposition of the bacterium on, various parts of the stem.

At 22° to 30° C. the incubation period of the disease and the degree of severity of attack were found to depend on the age of the host or of the infected organs. On young plants the first symptoms usually appeared 15 to 20 days after inoculation, wherever it was effected. On older plants the incubation period was longer, some showing no outward symptom even after two months, though the stem tissues were markedly disorganized. On young fruits the size of a nut or even larger, white spots appeared three days after deposition of the organism; on well-developed fruits or those that were beginning to colour, positive results were not obtained.

Observations indicated that the seed in infected fruits is probably diseased, but such seed showed no sign of the condition, ripened normally, and showed no reduction in germinability. Of 80 plants grown from seed from affected tomatoes sown at the end of August, 1938, only three showed the disease in November.

Attempts to transmit the disease to potato, tobacco, eggplant, and pimento gave negative results.

Troy (V. S.). **Mold counting of Tomato products.**—*Canner*, cii, 22, pp. 26–28, 30, 1 fig., 1 diag., 1946.

Directions are given for the application of the 'Howard mould count', the procedure recognized by the Association of Official Agricultural Chemists (United States), to the microbiological investigation of commercial tomato products [cf. *R.A.M.*, xxi, p. 309]. Among the most prevalent contaminants are *Alternaria*

[? *tomato*], *Colletotrichum* [*phomoides*], *Fusarium* [*bulbigenum* var. *lycopersici*], and *Mucor* sp. (especially on tomatoes held for a long time before canning). The following are some of the practices contributing to a low mould count: efficient sorting and trimming of the fruits; regulation of the speed of sorting and trimming belts to a maximum of 25 ft. per minute; shallow piling of the tomatoes on the belt, preferably in a single layer; thorough washing of the fruits by sprays of 100 to 150 lb. pressure; and strict attention to sanitation of all equipment, including passage of the sorting and trimming belts through a disinfectant bath prior to their return journey.

Best (R. J.). **Thermal inactivation of Tomato spotted wilt virus. Part 1.**—*Aust. J. exp. Biol. med. Sci.*, xxiv, 1, pp. 21–25, 1 graph, 1946.

The thermal death point of the tomato spotted wilt virus, i.e., the maximum temperature at which active virus could be demonstrated in *in vitro* experiments after a ten-minute exposure, was 45·5° C., the rate of inactivation at 35° following a logarithmic course and behaving as a first-order reaction with a half-life period of 20 minutes. In preliminary tests on the thermal inactivation of the virus *in vivo*, 97 per cent. of the active principle in inoculated Dwarf Champion glasshouse tomatoes was inactivated by 24 hours' exposure to an air temperature of 40°. The results of another series of trials on naturally infected Early Dwarf Red and Ponderosa field plants were comparable, but presented certain anomalies in the case of the former variety due to the presence of another, unidentified virus together with that of spotted wilt. The bearing of these results on the behaviour of experimental material during alterations of hot and cool weather is discussed.

Best (R. J.). **Inactivation of Tomato spotted wilt virus by salicylate.**—*Aust. J. exp. Biol. med. Sci.*, xxiv, 1, pp. 26–31, 2 graphs, 1946.

The tomato spotted wilt virus was inactivated by potassium salicylate solutions [*R.A.M.*, xix, p. 496] at a concentration of 0·02 M and upwards, the pH being maintained at 7 and the temperature at 30° C. At and above a salicylate concentration of 0·25 M inactivation was instantaneous, while between 0·02 and 0·07 M the process followed a logarithmic course at a measurable velocity.

Waterman (Alma M.). **Canker of hybrid Poplar clones in the United States caused by Septoria musiva.**—*Phytopathology*, xxxvi, 2, pp. 148–156, 1 fig., 1946.

A canker disease of hybrid poplar clones in two plantings in New York State and one in Tennessee is caused by *Septoria musiva*, hitherto reported only on exotic and hybrid poplars in Canada and Argentina [*R.A.M.*, xxiii, p. 365]. Infection occurs through uninjured leaves and petioles or twig wounds and soon after pycnidia and spores appear. Cankers are formed on twigs of the current season's growth and subsequently on the stems, the latter being girdled in susceptible species; in more resistant ones the cankers may become infected by secondary fungi, such as *Cytospora* (?) *chrysosperma*, which outstrip *S. musiva* in their rate of development and tend to mask its presence.

The author tested by greenhouse and outdoor inoculations with *S. musiva* the reactions of ten hybrid clones with proved adaptability to reforestation. Infection occurred in uninjured leaves and petioles as well as in stem wounds. The fungus was reisolated from the cankers formed. A high degree of susceptibility was indicated for one clone with a parentage of *Populus nigra* × *P. laurifolia*, two of *P. maximowiczii* × *P. berolinensis*, and one of *P. maximowiczii* × *P. nigra* var. *plantierensis*, whereas all the inoculations on *P. candicans* × *P. berolinensis* gave negative results.

Cristinzio (M.). **Le malattie crittogamiche del Noce (Juglans regia L.).** [The fungal diseases of Walnut (*Juglans regia* L.).]—*Ric. Ossvz. Divulg. fitopat. Campania ed Mezzogiorno* (*Portici*), ix, pp. 17–64, 3 pl., 9 figs., 1942. [Received April, 1946.]

Full notes are given on the following walnut (*Juglans regia*) diseases in Italy, with special reference to the conditions obtaining in the Campagna: 'mal secco' (*Phytomonas* [*Xanthomonas*] *juglandis*) [*R.A.M.*, xi, p. 766; xxiv, p. 170], 'mal nero' (*Phytophthora cambivora*) [ibid., xiii, p. 336; xix, p. 68], anthracnose (*Gnomonia juglandis*) [*G. leptostyla*] (stat. conid. *Marssonia* [*Marssonina*] *juglandis*) [ibid., iii, p. 197; xxii, p. 117; xxiv, p. 387], downy spot (*Microstroma juglandis*) [ibid., xix, p. 309], trunk and branch rot (*Polyporus sulphureus*, *P. hispidus*, *P. squamosus*, and *Fomes igniarius*) [cf. ibid., xv, p. 330; xvi, pp. 358, 715], white disease or root rot (*Rosellinia necatrix* and *Armillaria mellea*) [cf. ibid., xxi, p. 311], crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*), powdery mildew (*Microsphaera alni*), leaf-withering due to *Ascochyta juglandis* [ibid., xix, p. 309], and fruit scab (*Gloeosporium epicarpii*) [ibid., xiv, p. 204].

'Mal secco' disease occurs in all parts of Italy, particularly in the south. Spread is favoured by injuries to the trees caused by insects (especially *Cossus cossus*), weather, and human agency, e.g., striking the branches with poles when gathering the nuts. This practice should cease. Insecticidal treatments should be applied, and wounds disinfected with a 15 per cent. solution of iron sulphate and painted with tar or red lead. Crown-grafting should be practised instead of cleft-grafting. Careful pruning immediately after harvesting is also advised. Spraying with ordinary Bordeaux mixture should be carried out immediately the fruit has set.

The most serious and important walnut disease in Italy is 'mal nero' or ink disease. It is very prevalent, and causes heavy losses in the Campagna, particularly in the provinces of Salerno and Naples. If any walnut tree develops a slight or partial leaf yellowing, the main roots should be uncovered [cf. ibid., viii, p. 474]. If black spots are found, confined to the collar and roots, all the diseased tissues should be cut away and the wounds disinfected as usual. The roots should be left uncovered, and they and the base of the stem may be painted with a 10 to 15 per cent. solution of iron sulphate, or with 5 per cent. copper sulphate, or with milk of lime. The roots of destroyed trees should be removed from the soil and the area not replanted for some years. *Gnomonia leptostyla* is most prevalent in the Po valley, Tuscany, the Campagna, and Calabria. Applications of Bordeaux mixture (1 to 1·5 per cent.) should be made at fruit-set, early in August, and immediately after harvest, when infected parts should be removed. *Microstroma juglandis* is most frequent in the south and in Sicily, where it sometimes causes heavy losses. Bordeaux treatment is very effective; in localities where the disease is very prevalent, one or two pre-infection applications should be made in spring. If to spray very large trees is too expensive, the smaller ones and the young nuts, in particular, should always be treated. *Polyporus sulphureus* occurs frequently and was often observed in the provinces of Naples, Salerno, and Avellini, particularly on walnuts attacked by root rot and 'mal secco'. *P. hispidus* is also common. *P. squamosus* is as frequent but causes less damage. *F. igniarius* causes a common white rot. To control these fungi, tree surgery is recommended.

Rosellinia necatrix and *Armillaria mellea* are often associated with *Phytophthora cambivora*, the symptoms of which they mask, and the injurious effects of which they aggravate. During the early stages, good results are obtained by placing pieces of iron sulphate weighing 100 or 150 gm. at the base of the affected trees.

In the Campagna, *Bact. tumefaciens* attacks walnuts mostly when very young. Treatment is advised by surgical methods. Stable manure and organic fertilizers should not be applied heavily; the use of mineral superphosphate with iron sulphate is advantageous.

Powdery mildew occurs to some extent everywhere in the Campagna, being most frequent in thickly planted walnut groves near other fruit trees; it does not, however, cause much damage. Sulphur-dusting is indicated in general, but in old, severe infections two liquid treatments with 0·5 per cent. lime-sulphur or calcium sulphide at an interval of a fortnight should be applied when seasonal conditions favour the disease.

Ascochyta juglandis was first observed in 1932, near Nola, and since then has appeared in other parts of the Campagna. It is the least harmful of walnut diseases and causes a certain amount of damage only in wet seasons, when spraying with Bordeaux mixture should be carried out. *Gloeosporium epicarpii* is less common than *A. juglandis*, but more harmful. Spraying with Bordeaux mixture (1 per cent.) before flowering and after fruit-set is recommended.

In all cases infected material on the trees or on the ground and severely diseased trees should be burnt.

Conifer heart-rot (Fomes annosus (Fr.) Cooke Trametes radiciperda Hartig). Honey fungus Armillaria mellea Vahl. Agaricus melleus L. Two leaf-cast diseases of Douglas Fir.—*Leafl. For. Comm., Lond.*, 5, 7 pp., 3 figs.; 6, 7 pp., 4 figs.; 18, 6 pp., 3 figs., 1946.

These are entirely revised versions (January, 1946) of the popular accounts of conifer heart-rot (*Fomes annosus*); the honey fungus (*Armillaria mellea*), commonly found on young conifers but capable of attacking broad-leaved trees under certain environmental conditions; and two leaf-cast diseases of Douglas fir (*Pseudotsuga douglasii* and its var. *caesia* and *P. glauca*) [*P. taxifolia*] caused by *Phaeocryptopus gaeumanni* and *Rhabdocline pseudotsugae*, respectively [*R.A.M.*, vii, p. 482]. Leaflets 5 and 6 were originally published in 1921 and 18 in 1927.

Report of Committee on Preservatives.—*Proc. Amer. Wood Pres. Ass.*, xli, pp. 20–25, 1945.

This report and those of certain other committees (pp. 25–119) of the American Wood Preservers' Association deal, *inter alia*, with suggested changes in the specifications for the preservative treatments of timber in the United States [cf. *R.A.M.*, xxiv, pp. 347, 348].

Seyer (W. F.). **The leaching of copper, zinc and arsenic salts from wood piles.**—*Proc. Amer. Wood Pres. Ass.*, xli, pp. 137–144, 1 fig., 3 graphs, 1945.

An experiment is described which showed that the rate of leaching of toxic solutions from a 40-ft. Douglas fir [*Pseudotsuga taxifolia*] pile treated with a solution of copper sulphate, zinc sulphate, and arsenic trioxide and a so-called fixing agent was such that after one year 45 per cent. of the salts had been removed. How much toxic salt should be introduced into the pile to afford protection over a specified period of years is indicated by a graph.

Schmitz (H.), von Schrenk (H.), & Kammerer (A. L.). **Studies of the biological environment in treated wood in relation to service life. III. Changes in the character and amount of 60/40 creosote-coal tar solution and coal tar and the decay resistance of the wood of Red Oak crossties after five years' service.**—*Proc. Amer. Wood Pres. Ass.*, xli, pp. 153–179, 4 figs., 1 graph, 1945.

This paper completes the second of a planned series of studies on the biological environment in treated wood in relation to the service life of red oak [*Quercus* spp.] sleepers [*R.A.M.*, xxi, p. 108; xxiv, p. 348]. The present study deals with two red oak sleepers treated with 60 : 40 creosote-coal tar solution and two with coal tar, after five years on the track. It was again found that after five years' service, the greatest changes in the chemical and physical characteristics of both preservatives

occurred in the outer zones, with progressively smaller changes from the outside zone to the inner ones. Some of the differences in specific gravity and in the loss of low-boiling fractions found after three years between the bottom outer zone and the top outer zone appeared to have partly disappeared after five years, though the tar acid content of the preservative extracted from the bottom outer zone was lower, save in one instance, than that of the preservative extracted from the top zone. On the whole, it would seem that the rate of change of the preservative in the outer and inner zones declined during the last two years, particularly in the lower half of the sleepers.

The toxicities of the preservatives extracted from the outer zone of the bottom half of the sleepers after five, as after three, years' service were mostly lower than the toxicities of the preservatives extracted from the outer zone of the top half.

After five years, no significant difference was noted between the toxicity of 60 : 40 creosote-coal tar solution and coal tar, as regards the concentration necessary to inhibit or kill Madison 517 (*Fomes annosus*) or *Trametes serialis*. Thus, all differences in the initial toxicity of the preservatives had disappeared after five years' service. The evidence available strongly supports the view that the sleepers treated with 60 : 40 creosote-coal tar and with coal tar will give many more years' service. The importance generally attributed to differences in the initial toxicity of coal tar products requires modification.

In a written critical discussion of this paper (pp. 179–188), L. B. Shipley points out, *inter alia*, that the coal tar used in these studies was evidently of a special light grade; and hence, the results obtained do not apply to the usual coal tars.

Dosker (C. D.). **Laminating lumber suitable for wood preserving.**—*Proc. Amer. Wood Pres. Ass.*, xli, pp. 212–228, 12 figs., 1945.

A description is given of a new process for the lamination of timber products, by means of which the laminated timbers are rendered as resistant to decay, insects, and fire as solid timbers of the same kind of wood. Experimental and other work indicates that laminated products fabricated by the process described can be treated safely with preservatives.

Cristinzio (M.). **La Plasmodiophora brassicae Wor. nella Campania e la sua diffusione in Italia.** [*Plasmodiophora brassicae* Wor. in the Campagna and its prevalence in Italy.]—*Ric. Ossvz. Divulg. fitopat. Campania ed Mezzogiorno (Portici)*, ix, pp. 65–82, 2 pl., 2 figs., 1942. [Received April, 1946.]

In November, 1941, two extensive cauliflower plantations in the vicinity of Pompeii, situated on a flat, almost treeless plain near the river Sarno, were severely affected by club root (*Plasmodiophora brassicae*). Later inspections showed that the fungus was present in numerous other cauliflower plantings in the locality, other cultivated crucifers (but not the wild ones) also being affected, though much less severely. It appeared that the disease had been present for at least two or three years.

P. brassicae was first reported in Italy near Genoa in 1889 and the steady southward spread would appear to indicate that it is adapting itself to warmer climatic conditions. Apart from one report in 1901 from Avellino, the present outbreak of *P. brassicae* appears to be the first in the Campagna, the most southerly boundary of its extension. Its rapid spread in the area concerned is attributable to the local soil and climatic conditions, and cultural practices. The soil, especially near the river Sarno, is cold and damp, with stagnant water present in places during winter. Mists also occur at times. Infection, moreover, was favoured by heavy dressings of stable manure, and by neglect on the part of the growers to destroy the infected plants.

The control measures recommended consist in the removal of infected plants and, immediately after harvesting, of all plant remains, ceasing to grow cauliflowers for

two years or more (or, if continued, liming the soil at the rate of 400 to 500 kg. per ha.), making light applications of organic fertilizers with chemical supplements, transplanting only healthy plants, soil drainage, and seed disinfection by means of one hour's immersion in 0·25 per cent. uspulun.

Walker (J. C.), Jolivette (J. P.), & Hare (W. W.). **Varietal susceptibility in garden Beets to boron deficiency.**—*Soil Sci.*, lix, 6, pp. 461–464, 1945.

Trials were conducted in two localities in Wisconsin to determine the reactions of some garden beet varieties in common use to boron deficiency [*R.A.M.*, xxii, p. 335]. In 1940 and 1941 the most susceptible lots were Flat Egyptian, Light Red Crosby, Good for All, Morse Detroit, and one strain each of Early Wonder, Short Top Detroit, and Conners' Detroit. The indexes (two-year average) for these varieties (where 0 represents no disease and 100 all roots severely attacked) were 67, 58, 59, 54, 56, 62, and 54, respectively. One strain of Early Blood Turnip was resistant, and Long Dark Blood was virtually free from disease, with averages of 7 and 0·5, respectively. The remaining 21 stocks were intermediate in their responses. In 1944 further tests were carried out on nine varieties, of which Long Dark Blood was immune (average of four replicates 0), while the only others showing any appreciable degree of resistance were Crosby Egyptian and Early Blood Turnip (19 and 15, respectively).

Much significance is attached to these varietal differences in susceptibility to boron deficiency, which will probably need correction in all the stocks tested except Long Dark Blood. Beet improvement without reference to boron deficiency may be a cause of disappointment; the Good for All variety of fancy 'rosebud' grade, for instance, had to be rapidly discarded on account of its extreme susceptibility to internal black spot in boron-deficient soils.

Cook (R. L.) & Millar (C. E.). **The effect of borax on the yield, appearance, and mineral composition of Spinach and Sugar Beets.**—*Proc. Soil Sci. Amer.*, v, pp. 227–234, 3 figs., 1940. [Received July, 1946.]

At the Michigan Agricultural Experiment Station, a side-dressing of borax at the rate of 20 lb. per acre reduced the incidence of heart in rot in sugar beets [see preceding abstract] on Wisner silt loam soil from 96·9 to 11·4 per cent. and increased the yield from 7·2 to 14·3 tons per acre, with a corresponding increment in the individual root weight from 0·9 to 1·8 lb. The treatment likewise increased the sucrose and purity percentages from 14·1 to 18 and 80·9 to 84·9, respectively. Only insignificant further increases were obtained by a 40 lb. per acre application.

At a dosage of 10 lb. per acre, borax prevented the development of boron deficiency symptoms in spinach [*R.A.M.*, xvii, p. 717], which are almost identical with those in beet, and raised the yield from 8·1 to 14·3 lb. per plat. No advantage was derived from the application of larger quantities (up to 80 lb. per acre) of the fertilizer.

The modifications in the mineral composition of the plants induced by the soil amendments are described.

[A slightly different version of this paper appeared in *Bett. Crops*, 12 pp., 6 figs., 1941.]

Cook (R. L.). **Manganese sulphate and borax for Sugar Beets.**—*Sug. Beet J., 1946*, pp. 197–198, 1946. [Abs. in *Sugar*, xli, 5, p. 51, 1946.]

On alkaline or neutral soils in Michigan manganese is combined in a form too slowly available for sugar beets, the deficiency causing foliar mottling and reduction in yield [cf. *R.A.M.*, xxi, p. 468]. The characteristic leaf patterns appear in the early summer, in time for a remedial side-dressing of manganese sulphate. In 1943 the compound was applied as a side-dressing and spray on a farm in Tuscola county

at dosages of 100 and 5 lb. per acre, respectively. Marked differences in leaf colour were noticeable within ten days of the treatments, and the yields from the side-dressed, sprayed, and untreated plots were 17·8, 16·7, and 10·8 tons per acre. A less successful experiment with manganese sulphate in Bay county suggested the operation of some other limiting factor, possibly cold, wet weather, which tends to induce manganese starvation by retarding the oxidation processes in the soil. Sufficient borax should be included in the fertilizer to bring the rate of application to 8 to 10 lb. per acre [see preceding abstract].

ANDERSON (M. E.). **Two new wilt-resistant Pea varieties for processors.**—*Canner*, cii, 6, p. 22, 2 figs., 1946.

Descriptive notes are given on two new pea varieties resistant to wilt (*Fusarium* [*orthoceras* var. *pisi*]) in the United States, namely, Rogers Early Perfection, a cross between Premium Gem and Rogers Climax, and Rogers Wilt Resistant Thomas Laxton No. 251 [cf. *R.A.M.*, xxiv, p. 486].

PRYOR (D. E.) & WESTER (R. E.). **Relative resistance and susceptibility of U.S. 243 and U.S. 343 Lima Beans to Lima Bean mosaic.**—*Phytopathology*, xxxvi, 2, pp. 170–172, 1 fig., 1946.

Two promising varieties of Lima bean [*Phaseolus lunatus*], U.S. 243 and U.S. 343, were being increased for distribution in 1945. In one garden trial planting in June, 33 out of 49 plants in a 20-ft. row of U.S. 343 were found to be affected by a virus which was shown by inoculation tests to be similar to that described by Harter [*R.A.M.*, xvii, p. 788]. On the other hand, all 33 plants of U.S. 243 appeared healthy, and were shown by inoculations to tobacco to be resistant and not merely symptomless carriers.

The disease is of little economic importance, and the interest of these observations lies in the fact that both lines are derived from the same Fordhook × Sieva cross, in which the former parent is resistant and the latter susceptible. The fortuitous isolation of one resistant and one susceptible line emphasizes the need for strict attention to the pathological aspects of the breeding programme.

PRICE (W. C.) & BLACK (L. M.). **The antigenicity of southern Bean mosaic virus.**—*Phytopathology*, xxxvi, 2, pp. 157–161, 1946.

The southern bean mosaic virus [*R.A.M.*, xxv, p. 326] was shown to be antigenic, and its precipitin reaction can serve as a useful means for its differentiation from other viruses. It is serologically distinct from the viruses of tobacco necrosis and tomato bushy stunt, which it resembles in certain physical properties, and also from potato ring spot [potato virus X] and veinbanding [potato virus Y], and the tobacco mosaic and etch viruses. The anti-serum, prepared with purified southern bean mosaic virus, reacts specifically with the juice of infected Bountiful beans (*Phaseolus vulgaris*). These data supplement the cumulative evidence already presented as to the independence and specificity of the southern bean mosaic virus.

PORTER (R. H.). **Induced baldhead in Soybean.**—*Phytopathology*, xxxvi, 2, pp. 168–170, 1 fig., 1946.

Data obtained at the Iowa Agricultural Experiment Station in 1944 and 1945 indicate that soy-bean seed of high germinability, when planted in soil with a 15 per cent. moisture content naturally infested by *Pythium graminicola* and *P. debaryanum* and kept at 10° C. for 7 to 10 days before transferring to 26° to 28°, is likely to produce a large proportion of 'baldhead' seedlings, in which the plumule is partially or wholly decayed. In a test in 1944, of 400 untreated Bansei seeds planted under these conditions, 18·2 per cent. gave rise to 'baldheads', the corresponding figures for the lots treated with arason, spergon, and fermate being 1·4,

0·65, and 4·4, respectively. In a similar trial in 1945, the percentages of infection in the control lot and those treated with semesan jr., spergon, and arasan were 8·2, 7·2, 1·2, and 0·2, respectively, for the Kanro variety and 39·2, 19·5, 2·2, and 0·5, respectively, for Lincoln. In a test on the two last-named varieties to determine the effect of low temperature alone, 1 per cent. 'baldhead' developed both in the untreated and arasan-treated lots maintained at 10° for ten days.

WILSON (J. D.). **Relative susceptibility of Carrot varieties to nematode damage, yellows, and defoliation by blights.**—*Bi-mon. Bull. Ohio agric. Exp. Sta.*, xxxi, 239, pp. 35–39, 2 figs., 1946.

The aster yellows virus did not assume a virulent form on any of the 35 carrot varieties [*R.A.M.*, xxv, p. 248] tested in 1945 in Ohio for their reactions to this disease and the leaf blights caused by *Macrosporium* [*Alternaria carotae*] and *Cercospora carotae* [ibid., xxiv, p. 303], but its incidence exceeded 10 per cent. on Streamliner, Amsterdam Forcing, Short Top Shipper, St. Vallery, and Improved Short White. On the other hand, Coreless, Chantenay, French Market, Nantes Half Long, Luc, Goldenhart, and French Forcing showed less than 4 per cent. infection.

There was a wide variation in susceptibility to defoliation by *A. carotae* and *C. carotae*, perhaps due in part to the delayed development of severe infection until late in the season, by which time the tops of many of the early-maturing varieties had begun to die off from natural causes. Among the most susceptible were French Forcing, Nantes Half Long, Touchon, and Table Queen, while Chantenay, Red Heart, Hutchinson, French Market, and White and Yellow Belgians sustained little damage.

NUSBAUM (C. J.). **Internal brown spot, a boron deficiency disease of Sweet Potato.**—*Phytopathology*, xxxvi, 2, pp. 164–167, 2 figs., 1946.

In the course of experiments on the control of internal cork of sweet potato in South Carolina by soil amendments with borax [*R.A.M.*, xxv, p. 97], some plants in the untreated plots showed restriction of the terminal growth, shortening of the internodes, yellowing and shedding of the older leaves, and partial collapse near the crown. The roots were lopsided, dumb-bell- or spindle-shaped, and usually bore superficial cankers, sometimes covered with a hardened, blackened exudate, while scattered through the flesh, predominantly in the cambial zone near the periphery, were brown, indistinctly marginate, necrotic areas. The flesh of diseased roots was generally inferior in colour and consistency to that of sound ones.

Willis (*Spec. Circ. N.C. agric. Exp. Sta.* 1, 1943) has shown that small applications of borax often prevent the cracking of sweet potato roots and improve the flavour and texture of the flesh, and suggests that a similar treatment may reduce or eliminate the dark discoloration previously attributed to chilling at temperatures above freezing. In the writer's experiments, however, a small proportion of cracked roots occurred in nearly all the plots, irrespective of the amount of borax applied. Moreover, the internal brown spot herein described was observed in sweet potatoes which had not been exposed to temperatures below 50° F., either in the field or in storage, and was quite different from the discoloration and subsequent collapse of the flesh commonly ascribed to chilling injury.

BRANAS (J.) & BERNON (G.). **Essais de soufres et de produits soufrés à l'École Nationale d'Agriculture de Montpellier.** [Trials with sulphur and sulphur products at the National School of Agriculture, Montpellier.]—*Ann. Épiphyt.*, N.S., ix, 2, pp. 83–129, 10 figs., 8 graphs, 1943. [Received April, 1946.]

A full account is given of studies carried out at Montpellier in 1941 and 1942 on the use of sulphur and sulphur products against vine *Oidium* (*Uncinula*

necator). A laboratory method was used for estimating the activity of different forms of sulphur from the weight of sulphur vaporized by heat. The experiments showed that the volatility and hence the efficacy of sulphur dusts depend on the colour, the temperature, area covered, adhesiveness, and apparent density. Vaporization begins at a temperature probably over 18° C. but is not very great below 55°. If a filler is used it should be preferably of a dark colour. Field tests to determine the relative effectiveness of different sulphur treatments showed that when equal quantities of very finely powdered sulphur and flowers of sulphur are used under identical conditions, the action of the former on *U. necator* is not greater, and may be less, than that of flowers of sulphur. Experimental confirmation was obtained of the view that triturated sulphur is less effective than sublimed sulphur.

It was also found that as the size of the particles in a given weight of sulphur decreases, so the vaporization, at a fixed temperature and under identical conditions, increases to a maximum and then declines. It is not possible, however, to increase the effectiveness of triturated sulphurs by seeking a very high degree of fineness. Pure ventilated sulphurs are not a good form of sulphur to use for dusting purposes, but they are suitable for the manufacture of dusts containing small quantities of filler and of wettable sulphurs to be used in aqueous suspensions.

Comparisons of standard triturated sulphur with triturated sulphur (80, 50, and 25 per cent. free sulphur) containing crushed carbonate of lime as filler (added by dispersion) showed that, judged by the figures obtained for density, adherence, and vapour emission, the use of an inert filler reduces the amount of vapour emitted more or less proportionately to the amount of non-sulphur present. Hence, fillers added by dispersion adversely affect the probable effectiveness of pure sulphurs. Vineyard tests indicated that the effectiveness of a sulphur so filled declines rapidly with even a small addition of inert filler. The addition of a filler (bentonite) by impregnation was demonstrated in vineyard tests to be more favourable to the action of the sulphur than addition of a filler by dispersion.

Natural sulphurs enriched by the addition of 48 per cent. free sulphur are less effective than sublimed sulphur and less active also than triturated sulphur. Enrichment provides a convenient method of making use of impure sulphurs, but in ordinary circumstances the resulting effectiveness is less than that of pure sulphurs. Enriched sulphurs can be used in water like wettable sulphurs.

For an equal content of free sulphur, black sulphurs [*R.A.M.*, xv, p. 478] are distinctly superior to filled sulphurs, whatever filling method is used, though they are inconvenient to handle. Wettable sulphurs do not, by themselves, afford adequate protection, but they can usefully be applied in spring when weather conditions are against dust treatments, recourse to which should be had for the final applications. Colloidal sulphurs, under the conditions in which the experiments were made, were entirely unsatisfactory.

It is concluded that under all ordinary conditions, the pure forms of sulphur (sublimed and triturated) should be used in preference to any other sulphur product, the triturated form and other less active forms being reserved for rather resistant vines and for hot climates where the rate of vaporization is higher. Other forms of sulphur are of no interest unless economical and sufficiently effective. When it is not possible to obtain enough sulphur, the control of *U. necator* is likely to be incomplete. In such cases, wettable sulphur, which uses less sulphur than dusts, must be used for the first treatment or the first two, and impure sulphurs for the others. The lack of pure sulphur constitutes a danger to vineyards which grows greater every year, since each year the disease appears in a worse form than the year before, owing to previous inadequate treatment.

Moreau (L.), Vinet (E.), & Simon. **L'Oidium en 1942 au vignoble expérimental de Belle-Beille.** [*Oidium* in 1942 in the experimental vineyard of Belle-Beille.]—*Ann. Épiphyt.*, N.S., ix, 2, pp. 131–133, 1943. [Received April, 1946.]

Spraying and dusting trials carried out in 1942 against *Oidium* [*Uncinula necator*: see preceding abstract] in an experimental vineyard of Chenin vines at Belle-Beille, France, are described.

It is concluded that the inclusion of potassium permanganate (100 gm. per hectol.) in the cupro-arsenical mixture used for the first two treatments advised for susceptible vines should become a general practice in the Loire region. It allowed one sulphur dusting to be omitted and would have given even better results if a sticker had been used. Bordeaux mixture 1 per cent. with a sulphonated terpenic alcohol sticker exerts an appreciable effect on *U. necator*. Removal of leaves on a level with the bunches and on the east side only, during July, is essential in vineyards where growth is luxuriant. The use of bituminous sulphur containing 12 to 16 per cent. sulphur following spraying with potassium permanganate (125 gm. per hectol.) gave very satisfactory results on vines already badly infected. These conclusions apply only to the valley of the Loire and the vine varieties there grown.

Schad (C.). **Étude des facteurs de l'infection primaire et de la durée de l'incubation en vue de la prévision des époques de traitements contre le mildiou de la Vigne.** [A study of the factors of primary infection and of duration of incubation with a view to forecasting periods of treatment against Vine mildew.]—*Ann. Épiphyt.*, N.S., ix, 1, pp. 19–25, 1943. [Received April, 1946.]

After referring to the methods followed in France in forecasting outbreaks of vine mildew [*Plasmopara viticola*: *R.A.M.*, xvi, p. 513 and next abstracts], the author summarizes the data obtained in 1938, 1939, and 1940. In March, April, and May, specimen lots of infected leaves from local observation posts are examined in the station laboratory, and the progress of oospore germination under the local conditions is thus followed. The factors determining primary infection in the field are: the presence of active oospores (detected by laboratory observation), a temperature above 11° C., and a rainy period that keeps the surface of the soil wet for several days. From these it is possible to foretell exactly the period of primary infection. By following the temperature and rainfall and knowing the germinative capacity of the spores and their frequency, it is possible to predict also the extent of the first infection.

Secondary infections, due to the conidia, require the presence of active spores, rain, and a temperature over 8°. The prevailing temperature is always high enough in June and July. The persistence of water on the leaves for six or more hours at temperatures between 11° and 20° will inevitably induce infection. Intensity of attack depends on the extent of the primary infections, the coincidence of conidial formation with rain, the rainfall in June and July, and on the critical stages of vine growth (pre-flowering, end of flowering, and unprotected leaf area), and will determine the number of treatments required.

In calculating the incubation period [cf. ibid., xiii, p. 678], if only those hours in which the relative humidity is over 60 are considered, it is possible to time the appearance of the infection spots with greater accuracy. The proper use of all these data will enable the number of treatments to be reduced safely to a minimum.

Barraud (Mlle M.), Gaudineau (Mlle M.), & de Seze (M. R.). **Essais de traitement du mildiou de la Vigne en 1942 à La Grande-Ferrade (Gironde).** [Spray trials against Vine mildew in 1942 at La Grande-Ferrade (Gironde).]—*Ann. Épiphyt.*, N.S., ix, 2, pp. 135–161, 3 figs., 2 graphs, 1943. [Received April, 1946.]

In the attempt to find a means of economizing copper in the control of vine mildew [*Plasmopara viticola*: see next abstracts] experiments were carried out

during 1942 on ungrafted Cabernet vines in the Gironde in which (*a*) Bordeaux mixture containing different proportions of copper was tested against new or relatively unknown products containing little or no copper, and (*b*) a selection of the above was submitted to further test. Applications in both series were made on the four dates advised by the local spray-warning service.

A relatively severe outbreak of mildew in a year particularly favourable for it enabled an effective comparison to be drawn between the products. The results obtained (as estimated by the fraction of the fruit-bunches saved by 31st July, weight of crop per 100 vines, and amount of defoliation) showed that, under the experimental conditions, the effectiveness of 2 per cent. Bordeaux mixture was unequalled; 1 per cent. was less effective, but afforded sufficient protection; 0·2 per cent. was definitely inadequate, 0·5 per cent. marking, apparently, the limit of efficacy. When 0·2 per cent. sodium alcoylxanthate was added to 1 per cent. Bordeaux mixture, effectiveness became approximately equal to that of the 2 per cent. Product 18 (an active organic compound containing 2·6 per cent. copper), used at a concentration of 1 per cent., was among the best materials, judged by weight of crop in the first series and intermediate between Bordeaux mixture 1 and 2 per cent. in the second; this material deserves attention because of the reduction in copper it allows. Product 19, an organo-metallic (non-copper) compound used at 1 per cent., was distinctly active against the fungus and merits further test. Product 20, containing copper and arsenate, is also worth further trial, as is colloidal copper.

Raucourt (M.). **Vue d'ensemble sur les essais anticryptogamiques de 1942.** [A general view of the fungicidal trials of 1942.]—*Ann. Épiphyt.*, N.S., ix, 2, pp. 163–167, 1943. [Received April, 1946.]

Reviewing the results obtained in different phytopathological stations from spraying tests against vine mildew [*Plasmopara viticola*], the author concludes that it appears to be definitely established that copper salts in the state of mineral compounds exert a fungicidal action related to the number of copper ions liberated. There is very little likelihood of discovering any exceptionally active copper salts. The search for a means of economizing copper [see preceding and next abstracts], in normal circumstances, is hardly worth while, since reduction in the amount of copper used is bound to entail a reduction in yield, unless attack by *P. viticola* happens not to be severe.

The evidence obtained in 1942 having demonstrated that certain organic compounds are of use against vine mildew [see preceding abstract], laboratory work should be intensified in this direction.

Ciferri (R.). **Nuove idee in fatto di antiperonosporici.** [New ideas on anti-Vine mildew materials.]—*Ric. sci. Progr. tec. Econ. naz.*, xiv, 2–3, p. 134, 1943. [Received February, 1946.]

Further investigations carried out in 1942 by various workers in Italy on the control of vine mildew [*Plasmopara viticola*] by materials containing little or no copper [see preceding abstracts] gave the following results. Zinc salts are less fungicidal than copper salts, for the same weight of metal. The sulphur anion is that generally used. It appears certain that there is a reciprocal activating effect between very small dosages of copper salts associated with zinc salts, and possibly one of small amounts of zinc salts associated with copper salts. An increase in the anti-mildew activity of the oxyacids seems to be excited both on the copper salts and the zinc salts. No aluminium preparations have shown any appreciable fungicidal power. The value of mercury derivatives seems very doubtful. Given equal weights of copper, the form in which it is combined affects its fungicidal ability, especially with very low concentrations. A relative, indirect fungicidal effect

appears to result from absorption by vine leaves of micronutritive elements such as boron, iron, magnesium, manganese, copper, and zinc. The cuprobentonite substances offer a promising means of applying copper fungicides at low concentrations. Some of the oxyquinoline compounds can be effectively associated with the salts of heavy metals possessing fungicidal power. The importance of dust treatments in protecting the fruit bunches was confirmed. Fungicides containing 8 per cent. or less of copper require more exact timing for their application than those containing 16 or 24 per cent., and the importance of timing is strongly emphasized.

RIVERA (V.). **Sui marciumi radicali da Rosellinia necatrix e da Agaricus melleus: sensibilità per la temperatura dell' ambiente radicale, influenza del terreno e della natura del legname della pianta ospite; mezzi di lotta.** [On root rots caused by *Rosellinia necatrix* and *Agaricus melleus*: susceptibility due to the temperature of the root environment, influence of the soil and of the nature of the wood of the plant host; methods of control.]—*Nuovo G. bot. ital.*, N.S., xlvii, 2, pp. 477–487, 5 figs., 1940. [Received April, 1946.]

Continuing his studies on the effects of temperature on fungus-infected plants [*R.A.M.*, xiii, p. 197], the author found that infection of very young layer roots of specified varieties of vine by *Rosellinia necatrix* was complete 24 hours after experimental inoculation, at 25° [C.] in humid conditions. Infection by *Agaricus melleus* [*Armillaria mellea*] was much slower. In both cases, the degree of infection reached in 24 hours at 25° did not occur in eight days at 8° (in a refrigerator). At the latter temperature *R. necatrix* gave rise to no infection at all.

Cultures of both fungi on sterile, wet straw were kept for 17 days at 8°, 16°, 22°, 25°, and 43°. At 22° and 25° *R. necatrix* filled the bottles in seven days, while *A. mellea* took 45 days. At 8°, neither fungus grew, though both remained viable; at 43° both organisms were killed. Both fungi sown on wet straw in 48 bottles were at once exposed to a temperature of 43° under wet conditions for 0, 3, 6, 12, 24, and 48 hours. Exposure to this temperature for 6 to 48 hours killed the mycelium in every case, but exposure for three hours stimulated growth.

In tests on living plants, mycelium of *R. necatrix* was placed on vine layers grown in sterile water, and the plants kept in an illuminated thermostat. They grew well at 43° and even at 45° for three or four days; inoculation on the roots gave positive results at 25°, but never gave rise to the disease at 43°. Devitalization of the fungus, which had already begun its attack on the tissues, was definitive at 43°, both as regards the external and the intracellular mycelium. Inoculations at 25° killed the plants in six or seven days.

To investigate the possibility of killing the mycelium after it was strongly established in living roots, vine layers of four varieties were grown in bottles of water and soon after inoculation placed in a thermostat at 42° for six or 12 hours, controls being kept at 25° for the same periods. The controls after four days showed severe infection; later on they died. The plants exposed to 42° for 12 hours showed no infection, and grew vigorously. Comparable results were obtained with *A. mellea*.

From these and other experiments it is concluded that exposure to a temperature of 43° for six hours in wet conditions is sufficient to kill the mycelium of *R. necatrix* and *A. mellea* when growing on dead matter, while on living susceptible plants the periods necessary to kill the mycelium appear to be 10 hours at 42°, seven at 45°, and two at 53°, the plants themselves being uninjured by exposure to these temperatures. If, however, duration of exposure is too short, or the temperature too low, the result may be to stimulate mycelial growth.

When vine twigs in different types of soil were inoculated with the same two fungi, none of the soils inhibited or retarded the saprophytic development of the mycelium.

When the fungi were placed on pieces of ten different kinds of wood, in water, and kept at laboratory temperature or 23°, no growth occurred on chestnut [*Castanea*], almost none on Italian oak, and very little on Slavonic oak, while on the others growth was more or less rapid. Further work is in progress.

PRICE (W. C.), WILLIAMS (R. C.), & WYCKOFF (R. W. G.). **Electron micrographs of crystalline plant viruses.**—*Arch. Biochem., N.Y.*, ix, 2, pp. 175–185, 8 figs., 1946.

This is a more detailed account [cf. *R.A.M.*, xxv, pp. 59, 290, 326] of the illustration by electron-micrographical technique of molecular array in the southern bean mosaic and tomato bushy stunt viruses.

PRICE (W. C.) & WYCKOFF (R. W. G.). **Electron micrographs of molecules on the face of a crystal.**—*Nature, Lond.*, clvii, 3997, p. 764, 2 figs., 1946.

This is a description of the method of preparing shadowed replicas of the faces of single crystals of viruses for the purpose of making electron micrographs of the molecular disposition [see preceding abstract]. Two remarkable photographs prepared by this method show a shadowed replica of a single crystal of the southern bean mosaic virus, one magnified 8,200 times in which the regular array of molecular particles can be seen, and the other of parts of two adjacent crystal faces at a magnification of 26,000.

FRAMPTON (V. L.) & TAKAHASHI (W. N.). **Electrophoretic studies with the plant viruses.**—*Phytopathology*, xxxvi, 2, pp. 129–141, 5 figs., 2 diags., 1946.

A description is given of the moving-boundary method of electrophoresis, by means of which specific 'scanning patterns' were obtained for the extracts of healthy Turkish tobacco and of plants of the same variety infected with the tobacco mosaic virus, potato X and potato Y viruses, the cucumber mosaic virus, and Price's 'indicator' strain of the last-named [*R.A.M.*, xiv, p. 5]. These patterns are defined as obtained by 'successive exposures of a plate at different positions along the rear of the camera, with the knife edge set progressively higher and higher with each exposure . . . experimentally, the movement of the photographic plate is synchronized with the movement of the knife edge so that a continuous pattern is formed'. The scanning patterns of the above-mentioned viruses are not identical.

Specific scanning patterns were also obtained for healthy Otenashi pea beans [*Phaseolus vulgaris*] and those infected by Zaumeyer's bean virus 4 [southern bean mosaic virus: ibid., xxiii, p. 303; and above, p. 431].

Extracts from healthy tobacco plants contain three proteins, the concentrations and nature of which were not affected by the development of the mosaic virus in the plant. The appearance of the abnormality in the scanning pattern obtained with mosaic virus-infected tobacco plants coincides with the manifestation of symptoms in the plant. Healthy pea bean extracts yielded two proteins.

The scanning patterns obtained with virus-free Green Mountain and Cobbler potato tubers from virus-free seedlings are the same from seedling to seedling, irrespective of the duration of storage. More than one abnormality was observed in the patterns from apparently healthy field-grown tubers. Plants belonging to the same genus produce markedly similar patterns.

HEWITT (W. B.), HOUSTON (B. R.), FRAZIER (N. W.), & FREITAG (J. H.). **Leafhopper transmission of the virus causing Pierce's disease of Grape and dwarf of Alfalfa.**—*Phytopathology*, xxxvi, 2, pp. 117–128, 2 diags., 1946.

The methods and data [*Phytopathology*, xxxii, pp. 8 & 10] on the detection of leafhopper vectors of the viruses causing lucerne dwarf and Pierce's disease of the vine in California and the association of the two diseases in the field are described

[*R.A.M.*, xxi, p. 278], together with the technique and results of intertransmission experiments between the two hosts. Naturally viruliferous individuals of *Draeculacephala minerva*, *Carneocephala fulgida*, *Helochara delta*, and *Neokolla circellata* transmitted both viruses from diseased to healthy plants of the same hosts, and naturally non-viruliferous leafhoppers, after feeding on diseased plants, conveyed the inoculum from infected California Common lucerne to healthy Emperor, Malaga, Molinera, and Thompson Seedless vines and vice versa.

The majority of field collections of *D. minerva*, *C. fulgida*, and *H. delta* were non-viruliferous, whereas 59 per cent. of those of *N. circellata* tested were naturally viruliferous. The incubation period of the virus deemed to be implicated in the etiology of both diseases was under four days in *D. minerva*.

The distribution of vines suffering from Pierce's disease followed two general patterns, (1) irregularly scattered over the vineyard, and (2) concentrated in small areas. In both cases insects were indicated as the agents of transmission, and additional cogent evidence to this effect was afforded by the grouping of diseased vines under insect light traps. The vine disease tended to predominate in the vineyards of localities where lucerne was widely grown, and in the sections of the vineyards adjoining lucerne fields. Under the same conditions dwarf of lucerne was prevalent.

Root pieces from diseased vines inserted into lucerne roots were apparently responsible for the transmission of the virus in 12 out of 35 tests, but lucerne root pieces, similarly introduced into the stems of rooted vine cuttings, failed to transmit the infective principle.

Compte rendu sommaire des travaux poursuivis dans les stations et laboratoires de pathologie végétale. [Brief report on the work done in the stations and laboratories of plant pathology.]—*Ann. Épiphyt.*, N.S., ix, 2, pp. 271–283, 1943. [Received April, 1946.]

This review of the work carried out during 1942 [cf. *R.A.M.*, xxv, p. 328] at the plant-pathological stations of Versailles, Montpellier, Antibes, La Grande Ferrade, and Avignon contains the following items of interest, apart from those already noticed from other sources. Experiments on the control of peach leaf curl [*Taphrina deformans*: ibid., xxiv, p. 493; xxv, p. 206] showed that treatment with Bordeaux mixture or lime-sulphur on 24th February at bud-swell was more effective than later. A commercial brand of copper oxychloride used at a dosage of 2 per cent. gave very good results, while a commercial form of barium polysulphide was effective at 8·5 and 3 per cent. *Sphaeropsis pseudodiplodia* was frequently isolated from rotted loquat fruits; the fungus is very common on pomes in the Mediterranean area.

Important losses to eggplants growing in the irrigated alluvial plains in the lower valley of the Var were caused by collar cankers due to *Phomopsis vexans*. Marrow seedlings at Antibes showed necrosis of the cotyledons due to *Choanephora cucurbitarum* [ibid., xix, pp. 133, 513, 514]. Artichokes [*Cynara scolymus*] badly attacked by *Ramularia cynarae* produced only few and small heads.

Good results against wheat bunt [*Tilletia caries* and *T. foetida*] were obtained at the Central Station by seed treatments with chloronaphthol dip at 20 per 1,000, mercaptobenzothiazol dip at 20 per 1,000, chloromercuriphenol dust at 20 per 10,000, trioxymethylene 50 per cent. and talc (200 gm. per 100 kg. seed), and with product Cr as dust (200 gm. per 100 kg.), or as a dip at 1 per 1,000.

ITALY. **Phytopathological observations.**—*Int. Bull. Pl. Prot.*, xv, 4, p. 67 M, 1941. [Received July, 1946.]

The Royal Station of Plant Pathology, Rome, reports the following for the first time in Italy: *Oidium hortensiae* [*Microsphaera polonica*: see below, p. 451] on

the inflorescences only of *Hydrangea* plants in greenhouses and a mosaic disease on Précoce argenté peach trees, imported from France and grown near Ravenna. The Bouquetière sour orange (*Citrus vulgaris*) [*C. aurantium*] was proved to be very resistant to 'mal secco' (*Deuterophoma tracheiphila*) [*R.A.M.*, xxiii, pp. 128, 252]. Experiments confirmed the hereditary transmission of brown spot disease ('Eisenfleckigkeit') [internal rust spot: ibid., xxiii, p. 89] of potato tubers, but demonstrated that seasonal conditions exercise a strong influence on the manifestation of this disease.

BONTEA (VERA). **Noutati fitopatologice din 1942.** [Phytopathological notes for 1942.]—*Anal. Inst. Cerc. agron. Român.*, xv, p. 208, 1945.

According to an abstract of a paper read before the Rumanian Institute of Agricultural Research in January, 1943, sharp attacks of *Cladosporium cucumerinum* on cucumber, leaf mould of tomato (*Cladosporium fulvum*), and *Fusarium* wilt of cineraria were noted in Rumania in 1942. *Sporodesmium* [*mucosum* var.] *pluriseptatum* was serious on cucumber leaves; the association of *Cercosporina anethi* and *Phoma anethi* [*R.A.M.*, xvii, p. 771] was observed for the first time in Rumania, causing a blackening of apple stems; *F. oxysporum* caused a wilt of bullock's eye plants; black scab [wart disease] of potatoes (*Synchytrium endobioticum*) was recorded [apparently for the first time for Rumania: cf. ibid., xv, p. 252]; and a gummosis of sugar beet was produced by *Bacillus betae* [ibid., xxiii, p. 465].

CICCARONE (A.). **Italian East Africa. Plant diseases reported in 1939.**—*Int. Bull. Pl. Prot.*, xiv, 6, pp. 117 M–119 M, 1940. [Received July, 1946.]

In the note preceding this list of plant diseases [some of which are new] observed in [former] Italian East Africa in 1939, it is stated that [in Abyssinia] serious damage was caused to wheat by *Puccinia graminis*, *P. glumarum*, and *P. rubigo-vera* [*P. triticina*]; broad beans were appreciably affected by *Uromyces fabae*, haricot beans [*Phaseolus vulgaris*] by *U. appendiculatus*; and native flax by *Melampsora lini*. Economic losses were caused by the sorghum smuts *Sphacelotheca sorghi* and *S. cruenta*. *Oidium erysiphoides* [? *Erysiphe polygoni*] was frequent on green peas, lupins, broad beans, haricot beans, and sesame.

BENSAUDE (MATHILDE). **Rapport entre la distribution des bactéries et la flétrissure, dans les plantes parasitées par le Corynebacterium sepedonicum (Spieckermann et Kotthoff) Skaptason et Burkholder. Multiplication et migration du Corynebacterium sepedonicum dans les tissus des plantes infectées. Notes préliminaires.** [Relation between the distribution of bacteria and wilt in plants parasitized by *Corynebacterium sepedonicum* (Spieckermann & Kotthoff) Skaptason & Burkholder. Multiplication and migration of *Corynebacterium sepedonicum* in the tissues of infected plants. Preliminary notes.]—*Bol. Soc. broteriana*, Sér. 2, xx, pp. 5–31, 1946.

Greenhouse and field observations on some 40 Bonny Best tomato plants and 20 potatoes of different varieties, susceptible to bacterial wilt (*Corynebacterium sepedonicum*) at Aroostook Farm, Presqu'ile, Maine, confirmed Sherf's conclusions [*R.A.M.*, xxiii, p. 314] that invasion of the root system predominates under relatively cool conditions, while rising temperatures are accompanied by infection of the aerial organs.

The form of wilt described by Haasis from California [ibid., xix, p. 428] and also occurring in Maine appears to arise from the mass destruction of the rootlets, and there are usually no bacteria in the wilted portions of the plants. On the other hand, the wilting symptoms recorded by Saville and Racicot from Canada [ibid.,

xvi, p. 628] and Larson from the United States [ibid., xxiv, p. 164], which agree with those induced by the writer in greenhouse inoculation tests, develop exclusively in parasitized organs and apparently result from bacterial toxins or the dissolution of the phloem tissues at the sites of penetration. When the organisms invade stems or roots already provided with a well-developed secondary xylem, they remain virtually confined to the inoculated vessels and the secondary parenchyma, no necrotic cavity is formed in the phloem parenchyma, and no external symptoms of infection appear. The rootlets produced by diseased roots are flaccid and often reduced to a tubular pellicle.

Further studies on fixed and stained sections of stems, petioles, and roots of inoculated tomato plants showed that the parenchymatous tissues most favourable to bacterial multiplication—the only ones, in fact, subject to spontaneous invasion—are the phloem and xylem parenchyma. In these regions there are either no intercellular spaces or small ones filled with a solution of diffusible organic substances, thus differing from the air-filled interstices of the cortical parenchyma. However, even in such favourable sites spontaneous penetration and active multiplication of the bacteria occur only when they are in more or less direct contact with the functional vessels of the xylem. It would thus appear that the cell walls of the parenchymatous tissues must be actually imbibing the crude sap in order to promote active bacterial development. Possibly the crude sap contains the mineral elements, absent or insufficient elsewhere, which Skaptason has shown [ibid., xxiv, p. 337] to be indispensable to the growth of *C. sepedonicum*.

In conclusion, attention is drawn to the striking histopathological analogies between the potato and tomato wilt caused by *C. sepedonicum* and that of lucerne (*C. insidiosum*), as described by F. R. Jones [ibid., viii, p. 313] and Koehler and Jones [ibid., xi, p. 787]. The few differences between the two diseases are attributable rather to the structure and reactions of the several hosts than to dissimilarities between the causal organisms. The rapidity of wilting, even in cases of mild infection by *C. insidiosum*, is probably due to the abundance of gum formed in the vessels, which contributes largely to their obstruction and appears to be altogether absent from potatoes and tomatoes attacked by *C. sepedonicum*.

ARK (P. A.). **Mutation in certain phytopathogenic bacteria induced by acenaphthene.**—*J. Bact.*, li, 6, pp. 699–701, 1946.

Acenaphthene-saturated broth gave rise to permanent mutations in *Phytomonas michiganensis* [*Corynebacterium michiganense*] and *Erwinia carotovora* in experiments at the University of California, Berkeley. In some cells the changes occurred after a fortnight's growth on the medium at 28° C., the variants being detected on agar plates by dilution or streaking. A greyish-white, compact, flat, slowly growing colony of *E. carotovora*, recently isolated from carrot soft-rot, was only slightly pathogenic to the roots of its host, and one mutant of *C. michiganense* failed to attack tomatoes [*R.A.M.*, xxiii, p. 414]. No comparable effect was induced by acenaphthene on *Phytomonas* [*Xanthomonas*] *phaseoli*.

VOELCKER (O. J.). **Annual Report West African Cacao Research Institute, 1944–45.**—30 pp. [1946. Mimeographed.]

On p. 13 of this report a table is given presenting the information so far available on the symptoms produced by eight strains of the cacao swollen-shoot virus [*R.A.M.*, xxv, p. 293] in the Gold Coast. Strain A (New Juaben) causes defoliation, rapid die-back, and usually death of the tree in two or three years. The acute leaf symptoms consist in vein-clearing, red veinbanding, and mosaic. The chronic leaf symptoms are small, pale leaves, occasional veinbanding (fern pattern), and necrosis. The stem symptoms take the form of swellings and die-back. The

latent period is 120 days for the leaf symptom and 150 for the stem swellings. Strain B (Bisa) produces no effect on general health. The acute leaf symptoms consist in slight chlorosis, and there are no chronic ones. The stem symptoms are large swellings, and the latent period for these is 118 days. Strain C (Kpeve) results in reduced leaf production and stunting. The acute leaf symptoms are vein-clearing and red mottle, and the chronic are yellow mottle, necrosis, crinkle, and dark green veinbanding. No stem symptoms are present. The latent period for the leaf symptom is 114 days. Strain D (Nkawkaw) causes reduced leaf production and stunting. The acute leaf symptoms are red mottle and yellow flecking, and the chronic are occasional veinbanding. The stem symptoms consist in slight swellings and stunting. The latent period is 120 days for the leaf symptom and 360 or more for the stem swellings. Strain E (Pamen) causes reduced leaf production and stunting. The acute leaf symptoms are yellow flecking and the chronic yellow mottle (oak-leaf) and faint red veinbanding. The stem symptoms are medium swellings. The latent periods are 143 and 300 days for the leaf symptom and stem swellings, respectively. Strain F (Wiawso) causes defoliation, slow die-back, and premature death. The acute leaf symptoms are red veinbanding and vein-clearing, and the chronic are yellow veinbanding. The stem symptoms are large swellings and die-back. The latent periods are 124 and 360 or more days for the leaf symptom and stem swellings, respectively. Strain G (Dochi) exerts no adverse effect on health. The acute leaf symptoms are faint red veinbanding, and the chronic, yellow veinbanding. There are no stem symptoms. The latent period for the leaf symptom is 360 days or more. Strain H (Dawa) produces defoliation, slow die-back, and premature death. The acute leaf symptoms are red veinbanding and vein-clearing, and the chronic are mosaic and necrosis. The stem symptoms are swellings and die-back. The latent periods for the leaf symptom and the stem swellings are 58 and 100 days, respectively.

Out of a large population of healthy mature trees infected by budding with strain A, 44 per cent. were dead 18 months later, while the remainder are not expected to live. Inoculation of healthy trees with either of the mild strains B or C failed to confer immunity when strain A was budded on them a year later. It was demonstrated experimentally that strain A moves from the infected scion into the stock in under 24 days. Ring-barking tests showed that strain A is not generally carried in the xylem, in spite of the effects produced on this tissue. Of 7,278 seedlings from affected trees, none has developed virus symptoms.

The selection of isolated healthy trees in devastated farms has reached a total of 452. Budwood from them has been propagated and then infected with A. A high percentage have had to be discarded, but certain selections, of which five are outstanding, show only a slight check in growth, normal growth then following. These five clones are being rapidly propagated by budding. Good evidence has been obtained that tolerance exists.

So far as is known at present, the outbreaks in Nigeria are small and confined to Oyo Province. It has been reported that in the Ivory Coast [ibid., xxv, p. 295] the disease, though widely distributed in the eastern region, accounts for under 200 acres. Three strains appear to be present, two of which resemble A and F. Sierra Leone, French Togo, French Cameroons, and [French] Equatorial Africa appear to be unaffected.

Cutting out infected trees and apparently healthy contact trees eliminated the disease from 76 per cent. of outbreaks where there were fewer than ten infected trees and from 30 per cent. of those where there were ten or more. Eighteen of the outbreaks were re-treated once or more after the reappearance of the disease, and 15 of these re-treated outbreaks showed no sign of the disease two years afterwards. The loss of trees from 1939 to 1945 where cutting-out was practised

was ten times less than in an adjoining area of one square mile of comparable trees where no control was carried out.

KIŠPATIĆ (J.). **Über ungleiche Beizempfindlichkeit der Sporen verschiedener Brandpilze.** [On the unequal susceptibility to disinfectants of the spores of different smut fungi.]—*Phytopath. Z.*, xiv, 5, pp. 522–523, 1943. [Abs. in *Neuheiten PflSch.*, xxxvii, 2, pp. 44–45, 1944. Received March, 1946.]

The spores of wheat bunt (*Tilletia tritici*) [*T. caries*], barley covered smut (*Ustilago hordei*), loose smut of oats (*U. avenae*), and millet smut (*Sphacelotheca panici-miliacei*) were immersed for half an hour in abavit liquid 3330a, ceresan U. 564, fusariol liquid 2115a, and germisan liquid retort 3659 I, rinsed six times in distilled water, dried, and laid out for germination, those of the first-named species on liquid mud at 11° and of the others on 2 per cent. saccharose at 20°. The *doses curativae* in the case of *T. caries* were approximately the same for all the fungicides, but marked fluctuations were apparent in the resistance to treatment of the other smuts: For instance, ceresan, fusariol, and germisan had to be applied at twice as high a concentration against *S. panici-miliacei* as against *T. caries*, while conversely a much smaller quantity of abavit was required to inhibit the former smut than that needed for the latter.

CRÉPIN (C.). **Quelques enseignements à tirer des campagnes précédentes dans la culture du Blé.** [Some lessons to be drawn from the cultivation of Wheat in previous seasons.]—*C.R. Acad. Agric. Fr.*, xxvii, 1, pp. 42–50, 1941. [Received August, 1946.]

In discussing the effect of weather conditions on wheat in France between 1927 and 1941, the author states that in July 1940, when the plants still required six weeks' favourable weather to ripen normally, a period of incessant rain induced an exceptionally severe epidemic of *Puccinia graminis*, which involved almost the whole of France. The fungus appears nearly every year as a few pustules on the stems as the wheat matures, but in such conditions causes no damage and is not noticed. But in 1940, as in 1936, 1931, and 1930, which were all rainy years, the disease appeared earlier, when the wheat was far from mature. The effects of the outbreak were disastrous. In central France, fields which should have produced 20 ql. weighing 75 kg. per hl. gave only 10 or 12 ql. weighing 65 kg. or less per hl. In the north, fields which normally yield 35 to 40 ql. of full grain gave 20 to 25 ql. of grain weighing only 70 kg. per hl. The total loss was enormous.

All varieties are susceptible but, among heavy yielders, Préparateur Étienne is least so. To escape the disease as far as possible every effort should be made to ensure that the wheat reaches maturity at the normal time. The use of early varieties resistant to cold is advised. If sowing after January is unavoidable, varieties that ear easily when sown on the date selected should be used.

SĂVULESCU (T.). **Wheat rusts and Wheat scald during the year 1940. I. Rusts.**—*Int. Bull. Pl. Prot.*, xv, 10, pp. 181 M–185 M, 1 map, 1941. [Received July, 1946.]

During the autumn of 1939, wheat in Rumania developed light sporadic infection by brown rust (*Puccinia triticina*) [cf. *R.A.M.*, xxi, p. 249]. Towards the end of June, 1940, the disease was moderately severe in the Titu region, and at the conclusion of the growing period heavily attacked wheat in the Danubian Plain, from Fetești to Oltenița and up to the Station of Bărăganul, Mărculești (Ialomița Department). During the summer, attack by *P. graminis* was moderately intense in the Danubian Plain, Moldavia, and middle of Bessarabia, somewhat less so in Oltenia, and slight in Banat and Transylvania.

Peyronel (B.). **A proposito di un caso di deperimento di Frumento coltivato su prato naturale dissodato.** [On a case of dying-off of Wheat cultivated on ploughed natural meadowland.]—*Nuovo G. bot. ital.*, N.S., xlix, pp. 290–292, 1942. [Abs. in *Neuheiten PflSch.*, xxxvi, 2–3, p. 44, 1943. Received March, 1946.]

As a war-time measure, an area of natural meadowland in a Turin park was partially planted with potatoes and after these were lifted in the late autumn the whole was sown with wheat. In the portion of the field formerly occupied by the potato crop, the wheat sustained no appreciable parasitic injury, but in the other part it was severely attacked, notably by *Calonectria graminicola*, which occurred in a relatively mild form on the meadow grasses. The enhanced susceptibility of the wheat to fungal infection is attributed to its cultivation on an uncongenial soil.

Marchionatto (J. B.). **Argentine Republic. An epiphytotic of Wheat septoriosis.**—*Int. Bull. Pl. Prot.*, xv, 6, pp. 113 m–114 m, 1941. [Received July, 1946.]

Wheat in the Argentine Republic is attacked by *Septoria tritici* [*R.A.M.*, xxiv, p. 12] and *S. nodorum* [ibid., xxiv, pp. 222, 402, 445], the latter being the more serious. The disease, though present for many years, did not become of importance until latterly. It was observed in the vicinity of Pergamino and was subsequently found on several wheats in Buenos Aires, Santa Fé, Córdoba, and Entre Ríos. In 1939 it also occurred in Uruguay. Early varieties, sown from April to June, are the most susceptible. Disease development is favoured by mild temperatures, but for heavy attacks abundant rainfall is necessary.

Greaney (F. J.). **Influence of time, rate, and depth of seeding on the incidence of root rot in Wheat.**—*Phytopathology*, xxxvi, 4, pp. 252–263, 1946.

In field experiments in Manitoba from 1936 to 1939, inclusive, the incidence of root rot (*Helminthosporium sativum* and *Fusarium* spp.), the most widespread and destructive disease of spring wheat in the Province [*R.A.M.*, xxiii, p. 96], was reduced and the yield increased by early sowing. Thus, mean seedling root-rot ratings for the four years, using the Pentad variety in the two former and Mindum in the two latter, rose from 45·5 (where 0 = no disease and 100 = the maximum) for the 7th May sowing to 60·8 for that of 12th June, the corresponding figures for adult plants being from 30·8 to 56. During the same period the yields were 35·7 and 16·8 bush. per acre. Only in the plantings subsequent to 31st May was there an appreciable decline in the percentage of seedling emergence, which by 12th June had sunk to 58·8 per cent. compared with 67·8 for the 7th May sowing and 66·2 for that of 31st May. A clear-cut correlation was established between soil temperature and root rot in the date-of-sowing tests, the slight incidence of infection and heavy yields in the early-sown plots being associated with low mean daily temperatures (43·5° F. on 7th May), while the high temperatures of the later dates (50·7° on 12th June) were an important factor in the increase of disease and fall in yield.

From 1938 to 1940, inclusive, the amount of root rot rose progressively with increases in the sowing rate of Regent wheat from 50 to 500 seeds per 18-ft. row, the mean percentage of diseased plants at the former and the latter densities being 65·3 and 97·7, respectively, and the adult plant root-rot ratings 11·7 and 29·7, respectively. However, in spite of the consistently upward trend of the disease with increased sowing rates, the average yield for the three years rose from 18 bush. per acre at 50 to 32·7 at 500.

In tests in 1943 on the Thatcher and Red Bobs varieties, and in 1944 with the same two, Renown, and Regent, the severity of root rot increased with depth of planting (1 to 4 in. in the former and 1 to 3 in the latter year). The mean root-rot

ratings in 1943 for the 1-, 2-, 3-, and 4-in. depths were 15·3, 21·6, 23·1, and 24, respectively, and in 1944 for 1-, 2-, and 3-in. 17·5, 20·9, and 24·6, respectively.

It is evident from these results that root-rot losses in Manitoba can be reduced by relatively sparse and shallow sowing at the earliest feasible date.

GLYNNE (MARY D.). **Eyespot of Wheat and Barley in Scotland in 1944.**—*Ann. appl. Biol.*, xxxiii, 1, pp. 35–39, 1946.

Although considerably more wheat and barley were grown in Scotland during the war, the long rotations practised there usually include these crops less often than those of southern England. This tends to prevent more widespread incidence of eyespot (*Cercosporella herpotrichoides*) [*R.A.M.*, xxi, p. 521] in Scotland, but it was, nevertheless, detected in 90 out of 121 autumn-sown wheat crops distributed over 12 counties in August, 1944. In 40 fields the infection was sufficiently great to endanger subsequent crops and 11 crops were showing considerable loss. Seventeen out of 18 spring-sown barley crops were similarly attacked, with more than 50 per cent. straw infection in seven. Lodging, mostly due to eyespot, was observed in about 4 per cent. of the wheat inspected, and in about 38 per cent. of the barley, mostly as the result of non-parasitic agencies. The more humid atmosphere of Scotland favours the development of eyespot, and in 1944 the rainfall from April to July varied from 8·9 to 11·2 in. in eight counties. Frequent inclusion of cereals in the rotation increases the incidence of eyespot, which tends in Scotland to thrust higher up the straw and to infect spring-sown barley more severely than in southern England. Fairly severe outbreaks of eyespot were found, however, in a few fields where wheat and barley had not been grown for some years. It is also thought that close cereal cropping, which promotes the spread of eyespot, may be a factor discouraging the increase of wheat-growing in the damper areas of Scotland.

Take-all (*Ophiobolus graminis*), which was more common than eyespot in the counties of Dumfries and Aberdeen, was detected in 52 of the wheat crops, although only one had as much as 10 per cent. infection and most had less than one.

Sharp eyespot (*Corticium solani*) was most common in Aberdeenshire and was found in eight other counties, 34 crops in all being infected, mostly less than 1 per cent.

FREISLEBEN (R.) & LEIN (A.). **Über die Auffindung einer mehltauresisten Mutante nach Röntgenbestrahlung einer anfälligen reinen Linie von Sommergerste.** [On the detection of a mildew-resistant mutant after Röntgen irradiation of a susceptible pure line of summer Barley.]—*Naturwissenschaften*, xxix, p. 608, 1942. [Abs. in *Neuheiten PflSch.*, xxxvi, 2–3, p. 43, 1943. Received March, 1946.]

Air-dry seed-grain of a pure line of Haisa, one of the most prolific summer barleys *Hordeum distichum* var. *mutans*) was exposed to Röntgen rays at dosages of 4,000 to 14,000 r. In 1941–2, 12,000 X_1 progeny and 24,000 seedlings were tested in the greenhouse for their reaction to mildew [*Erysiphe graminis* var. *hordei*: *R.A.M.*, xxiv, p. 185] by a new mass-inoculation technique: of the plants from irradiated seed 19 were more or less resistant. Among the X_2 progeny inoculated in the field in 1942 was an absolutely mildew-free, vigorous, dark green plant, the fully fertile and otherwise normal X_3 offspring of which proved to be homozygous-resistant to physiologic races 1, 2, and 4 of the fungus.

PETRI (L.). **Recenti ricerche sul 'mal secco' degli Agrumi in Turchia.** [Recent researches on 'mal secco' disease of Citrus in Turkey.]—*Boll. Staz. Pat. veg. Roma*, N.S., xx, 2, pp. 81–98, 1940. [Received June, 1946.]

Discussing the researches of Gassner into citrus 'mal secco' disease (*Deuterophoma tracheiphila*) in Turkey [*R.A.M.*, xx, p. 398] in relation to observations

made by himself and other workers, mostly in Sicily [ibid., x, p. 182; xviii, p. 245], the author points out that whereas in Turkey the tangerine is more resistant than sweet orange, in Sicily and Calabria the reverse obtains. Furthermore, young sour orange trees are more susceptible than adult ones, though the reverse holds in Turkey. *D. tracheiphila* can hardly be identical with *Phoma limoni*, for the latter was reported in 1887, whereas 'mal secco', which is always accompanied by *D. tracheiphila*, since its discovery in eastern Sicily in 1918 has spread in turn to Syracuse, Palermo, and Reggio Calabria. The disease certainly reached Greece from Asia Minor and Palestine, and in its spread westwards and southwards the damage caused has become progressively worse. The author has on many occasions observed a species resembling *P. limoni* on citrus twigs with dried tips and evidently damaged by wind, but this species was a saprophyte or a weak parasite. The pycnidia of *P. limoni* are easily visible externally, whereas those of *D. tracheiphila* are not, even with a lens. They are always covered by the epidermis, which assumes an ashy colour; this is a diagnostic character of the fungus. Further, they measure 35 to 50 μ in diameter (exceptionally, 80 to 90 μ), whereas, in Italy at least, those of *P. limoni* are 60 to 135 μ. Penzig's description and figure show the pycnidia to be depressed and ostiolate, whereas those of *D. tracheiphila* are mostly globose, seldom lentiform, and only a few at maturity present a slight thickening which might be a trace of an ostiole. There is, finally, no relation between *P. limoni* and the incidence of 'mal secco', since the fungus is present where the disease has never appeared. The strain of *Deuterophoma* attacking citrus in Turkey may well differ slightly from that found in Sicily and Greece.

It is inexact to say that the symptoms described for 'mal secco' before Gassner's paper appeared included those caused by frost as well as those due to *D. tracheiphila*. The symptoms described for Sicily at least have nothing to do with frost. Gummosis of the cambium, which is always present in herbaceous twigs after infection by *D. tracheiphila*, and is attributed by Gassner exclusively to frost predisposing the plant to fungal infection, is always in Sicily and Calabria (whatever may be the case in Turkey) due directly to infection, as has been shown in inoculation experiments where no frost injury was present. Such primary infections of the shoots are of frequent occurrence in Sicily during autumn, at which season no damage from frost has ever been known locally; and even in these infected shoots gummosis of the cambium is often present. Gum infiltrations in the woody vessels of the branches and stems have never been regarded by the author as specific symptoms of 'mal secco', though he noted them as accessory pathological characters often attributable to causes other than the disease. To the internal symptoms of true 'mal secco' listed by Gassner gummosis of the cambium of the green branches must be added, though it may, possibly, sometimes be due to frost also. Finally, 'mal secco' is markedly contagious, independently of cultural and environmental conditions.

What Gassner terms 'brown mal secco' evidently corresponds with the form of the disease found by the author in Greece, in which the woody tissue is not the usual orange-red, but brown. The mycelium of *D. tracheiphila* isolated from such branches did not form a red pigment, but in its other characters the fungus was identical with the chromogenous form. According to Gassner, this brown discoloration is due to frost damage only, not to true 'mal secco'. The author's view is that frost damage may be present in such cases, but only as an accessory factor to infection by *D. tracheiphila*. The frost damage in the cambium described so exactly by Gassner has not been observed in Sicily.

Cold does not predispose the trees to primary infection in Sicily and Calabria, and here sour orange is more resistant to cold than sweet orange but markedly susceptible to 'mal secco', while sweet orange is definitely resistant; tangerine is more resistant to cold than sweet orange, yet less resistant to 'mal secco'. It may

be that the Turkish lemon, Mola Mehmed, being more resistant to cold, is also more resistant to 'mal secco', but this does not apply to the Interdonato or the Monachello lemon.

The author concludes that the infective nature of the disease is confirmed, though he and Gassner differ on the systematic identity of the fungus, and on the conditions which predispose the trees to infection.

Bliss (D. E.). **The relation of soil temperature to the development of Armillaria root rot.**—*Phytopathology*, xxxvi, 4, pp. 302–318, 7 figs., 1 graph, 1946.

This is a report on a series of six soil temperature tests at the Citrus Experiment Station, Riverside, California, designed to yield further information on the environmental factors affecting the root rot caused by *Armillaria mellea* on the following nine economic and ornamental plant species: Koethan and Homosassa sweet and Standard sour orange [cf. *R.A.M.*, xxiv, p. 225], Sampson tangelo (*Citrus paradisi* × *C. reticulata*), California pepper tree (*Schinus molle*), *Casuarina stricta*, Lovell peach, Royal apricot, *Pelargonium hortorum*, and Ragged Robin rose. The plants were inoculated with the pathogen and grown for 181 to 438 days in the greenhouse in five soil-temperature tanks, the water baths in which were maintained at different controlled temperatures, ranging approximately from 7° to 38° C. The air temperatures in the greenhouse ranged mostly from 21° to 27°.

The optimum temperatures for root growth in uninoculated peach, *C. stricta*, *S. molle*, *P. hortorum*, and apricot (group A) fell between 10° and 17°, and those for citrus and rose (B) between 17° and 31°. The top growth of citrus was greatly retarded at soil temperatures of 10° to 12°, the new leaves being small and very chlorotic, and stimulated to maximum production at 27° to 31°. The minimum and maximum temperatures for root growth were 12° and just below 38°, respectively. All the peach, apricot, and *P. hortorum* plants died at 38°, the maximum production of top growth by the first two occurring at 31° and the minimum at 10°, while the corresponding figures for the last-named were 17° and 31°, respectively. The top growth of *S. molle* was delayed at 10° but was vigorous and of almost equal luxuriance at 15° to 30°. The growth rate of roses was accelerated from 8° to 28°. The top growth of *C. stricta* fell to a minimum at 7° and reached a maximum at 27°.

The rhizomorphs of *A. mellea* developed most rapidly in sterile, deep nutrient agar at 19·7° and 24°, a decrease in the growth rate being observed at 10°, 14·6°, and 27·4°, while only slight growth was made at 31° and 5°, and none at 36°. The pathogen remained viable in inoculum within the controlled temperature range of 7° to 28° throughout the test periods of 181 and 438 days, after which lengthy periods the maximum rhizomorph development in non-sterile potting soil was made at the lowest experimental temperatures. No explanation is forthcoming of the apparent inconsistency in the effect of temperature on rhizomorph development on agar and in soil.

Root-rot symptoms were observed in the test plants at a soil temperature range of 7° to 25°, with an optimum for pathogenesis in group A from 15° to 25° and in B from 10° to 18°. All the plants exerted their maximum resistance to infection at temperatures most propitious to root growth. In any host of *A. mellea* there are two critical temperatures for root-rot development, one at each extremity of the range for pathogenesis. Of these the upper limit, round about 26° for all the species used in these tests, is the more important. In southern California the prevalence of the disease throughout the coastal regions, and its presumed absence from the inland desert areas, appear to be related to differences in soil temperature, which largely exceeds 26° at 1- to 4-ft. depths at Indio (desert) for three months of the year, whereas at Anaheim, on the coast, it seldom reaches this point. In the latter district, pathogenesis among the representatives of group A would be

expected to develop at the maximum rate from the spring to the autumn, and among those of B from the late autumn to the spring.

Leach (R.). **The unknown disease of the Coconut palm in Jamaica.**—*Trop. Agriculture, Trin.*, xxiii, 3, pp. 50–60, 5 pl., 1 graph, 2 maps, 1946.

Detailed researches by the author, supplemented by visits to Trinidad, British Guiana, and Haiti, have convinced him that the disease of the coco-nut palm, known locally in Jamaica as 'west-end bud rot' and considered by Briton-Jones [*R.A.M.*, xx, p. 111] and Bain [ibid., xx, p. 200], but doubtfully by Martyn [ibid., xxiv, p. 367], to be identical with the bronze-wilt disease, is distinct from that malady. He prefers to designate it, pending the results of further study, as 'the unknown disease'.

The following symptomatological differences between the unknown disease and bronze wilt are pointed out. There is no foliar discoloration in the former throughout the nut-fall period, at the onset of which nuts of all sizes fall particularly on one side of the tree, whereas a definite bronzing and yellowing of several leaves is a first symptom of bronze-wilt disease and the youngest nuts fall first with no such unilateral abscission. When bronzing becomes obvious in the former, there are no nuts left on the palm, while there may be many on severely bronzed palms in the latter; discoloured inflorescences are a primary symptom in the unnamed disease, and five spathes may wither before the heart dies, but in wilt they may remain healthy until bronzing is well developed and only two or three may wither before death of the heart. Bronzed leaves in the unnamed disease maintain a normal angle when dry and later fall without drooping down the stem instead of hanging down in close clusters round the stem after drying, as in bronze leaf wilt. In young plants the unknown disease may be diagnosed with certainty if bronzing is accompanied by die-back of the heart leaf.

No likely causal pathogen of the unnamed disease has been isolated and active growth in surface feeder-roots was observed even after all the nuts had fallen, but in the final stages root activity ceased. A species of *Rhizoctonia* (? *R.* [*Corticium*] *solani*), isolated from the junction of healthy and diseased tissues of very young and moribund palms, was inoculated into the base of the young plants, but the resultant rapid infection was soon confined to an area round the point of inoculation. Periodic measurements throughout the growing period showed that in bearing palms leaf growth did not decrease until bronzing appeared, that nut growth slowed soon after infection, and that diseased spathes opened rapidly.

Leaf growth of young diseased plants is arrested so suddenly that early stages of the disease can be more accurately estimated by noting their rate of growth than from any change in foliage colour, for bronzing may not occur until leaf growth has almost ceased.

The data collected suggest that the disease is favoured by seasonal conditions which encourage vigorous growth and not by those causing physiological die-back of the roots through drought or waterlogging. As in the case of bronze wilt, the more luxuriantly the palms grow, and the better their yielding capacity, the more susceptible they seem to be to the disease. On the other hand, very few new cases were recorded, at the height of the drought, in contradistinction to bronze wilt.

The fact that different rates of incidence distribution have been observed on different soils, whereas on uniform soils the spread is uniform, inclines the author to consider that this may be due to the varying nutrient status of the plants growing on different soils. The disease appears unable to spread over short distances.

In Haiti the Department of Agriculture have known of the disease for the past 15 to 20 years around Cap Haitien and Port de la Paix and there are references to what would seem to be the same malady in the Cap Haitien area as far back as 1880. In two years from 1943, however, the disease developed with a virulence

surpassing that of Jamaica and 8,000 coco-nut-bearing palms were killed in and around the town of Gonaives. Its appearance has been reported in the Grande Rivière valley and round Plaisance, the mild incidence being possibly attributable to the palms there being scattered among coffee and banana plantations, whereas those at Gonaives are densely set. The soil round Gonaives is highly alkaline, and that round Limbe free-draining and slightly acid, which weakens any theory of soil deficiency as a possible causative factor, and while young plants on the northern plain are not affected until they reach the bearing stage, they acquire the disease at Gonaives when much younger. At Gonaives mortality of date palms (*Phoenix dactylifera*) and some royal palms (*Roystonea oreodoxa*) has occurred, starting with the withering of the lower leaves and the inflorescences and rotting of the heart leaves, symptoms recalling the rhizosis of date palms in California described by Bliss [ibid., xxi, p. 195] and associated with the fungus *Ceratostomella radicicola*. It is impossible to say at present whether the disease is the same as that attacking the coco-nut.

M[AYNE] (W. W.). **Hemileia vastatrix in India.**—*Plant. Chron.*, xl, 23, pp. 384–387, 1946.

Three major reasons are adduced for the survival of the Arabica coffee industry, notwithstanding the presence of leaf rust (*Hemileia vastatrix*) in South India, where the crop covers 200,000 acres, with approximately 75 per cent. in the Western Ghats of Coorg and Mysore. (1) The seasons are more strongly marked in South India than in Ceylon, where the disease caused the collapse of the industry, with a clearly defined dry season from late November to mid-March. (2) In South India coffee has been consistently cultivated under a practically continuous shade canopy, which influences leaf rust directly by checking spore dissemination and indirectly by reducing light intensity and diurnal temperature fluctuations and generally providing unfavourable conditions for the fungus. (3) The Kents strain of coffee cultivated in South India since the 1920's is more resistant to leaf rust than Coorg, which in the 1880's superseded the original strain planted from 1840 to 1860, but gradually lost its capacity to withstand the disease. The writer's studies have shown that the differing reactions to *H. vastatrix* of the two varieties rest on the existence of physiologic races of the rust [*R.A.M.*, xv, p. 798].

SIMPSON (D. M.) & WEINDLING (R.). **Bacterial blight resistance in a strain of Stoneville Cotton.**—*J. Amer. Soc. Agron.*, xxxviii, 7, pp. 630–635, 1946.

A strain of upland cotton, U.S.D.A. Stoneville 20, has been isolated which is highly resistant to natural and artificial infection by bacterial blight (*Xanthomonas malvacearum*). The resistant character has been transmitted to selections from Stoneville 20 hybrids and the susceptible Stoneville 4 and Trice A varieties and to their back-crosses, thereby opening up a hopeful prospect for the introduction of this factor into varieties adapted to production in different sections of the Cotton Belt. By means of a simplified adaptation of Knight and Clouston's method of field inoculation [*R.A.M.*, xviii, p. 796], providing epidemic conditions in the breeding plots, plants may be selected with reasonable certainty as to their resistance to the disease.

WEBB (SHIRLEY). **Australian ambrosia fungi. (Leptographium lundbergii Lagerberg et Melin, and Endomycopsis spp. Dekker).**—*Proc. roy. Soc. Vict.*, N.S., lvii, 1–2, pp. 57–80, 1 pl., 8 figs., 1946.

This paper includes a full account of the fungus *Leptographium lundbergii*, which together with two species of sporogenous yeasts belonging to *Endomycopsis* was constantly isolated from the tunnels of the Australian ambrosia beetle *Platypus*

subgranosus in *Nothofagus cunninghamii* and two other timbers. An affinity is suggested between *L. lundebergii* and *Ceratostomella ips*. It is conceivable that the *Endomycopsis* spp. serve the beetle as food or assist indirectly by stimulating *L. lundebergii* and in this connexion it is noted that Miss Rumbold [*R.A.M.*, xx, p. 551] found yeasts were the first organisms to appear round beetle galleries, blue-stain fungi only developing later.

Régnier (R.). **Résultats de l'enquête et des récentes recherches sur les Hannetons.** [The results of the inquiry into and of recent researches on Cockchafers.] —*C.R. Acad. Agric. Fr.*, xxvii, 5, pp. 325–344, 1941. [Received August, 1946.]

In this study on the damage done by cockchafers (chiefly *Melolontha melolontha*) and their control in France the author states that attempts to destroy them by inoculation with *Isaria* [*Beauveria*] *densa* [*R.A.M.*, xvi, p. 531; xxii, p. 480] have given only partial and irregular results, since the conditions in which the fungus develops have not yet been ascertained. Trials with bacteria have also been carried out, but the results are not yet known (1939). The natural action of *B. densa* was, however, found to be very extensive in argillaceous soils of average humidity, especially in certain fields, where mortality of larvae in the spring of 1940 reached 90 per cent. Attempts at laboratory contamination were invariably successful in the same soils, but failed in soils that dried quickly. Further work is planned.

Paillot (A.). **Rôle des facteurs microbiens dans la destruction naturelle de la Cochylis et de l'Eudémis de la Vigne.** [The part played by microbial factors in the natural destruction of Vine *Cochylis* and *Eudemis*.]—*C.R. Acad. Agric. Fr.*, xxvii, 3, pp. 151–155, 1941. [Received August, 1946.]

In a study of the natural causes of death among the pupae and larvae of the vine moths *Cochylis* [*Polychrosis botrana*] and *Eudemis* [*Clysia ambiguella*] in France, the author found that the commonest fungal parasite of these insects is *Spicaria farinosa* var. *verticillioides* [*R.A.M.*, v, p. 97]. *Citromyces glaber* [*Penicillium glabrum*] was found once only, and *Beauveria bassiana* was also observed. *Verticillium heterocladum* [ibid., xi, p. 641] was encountered more frequently than either *P. glabrum* or *B. bassiana*, but plays only an unimportant part in natural control. About 30 per cent. of the larvae and pupae were mummified by fungal infection. The spread of *S. farinosa* var. *verticillioides* may become reduced as a result of hyperparasitism by *Melanospora parasitica* [ibid., xxv, p. 113], which was also observed by the author.

Loughnane (J. B.) & McKay (R.). **Observations on the pasmo disease of Flax and on the causal fungus Sphaerella linorum Wollenweber.**—*Sci. Proc. R. Dublin Soc.*, N.S., xxiv, 10, pp. 89–98, 4 pl., 1946.

The symptoms of the 'pasmo' disease of flax (*Sphaerella linorum*), first detected in Eire in 1944 [*R.A.M.*, xxiv, p. 102], are described as they affect the cotyledons, stems, leaves, sepals, pedicels, and internal parts of the boll. Inoculation experiments on the Liral Crown variety with a monospore culture of the fungus from *Linum angustifolium* confirmed the existence, already observed by other workers, of a phase of high resistance to infection between the cotyledonary and flowering stages.

An interesting feature of the germinated pycnospores is their capacity for anastomosis, the significance of which is not clear. Another type of germination was observed in which the pycnospore budded off an elliptical secondary spore 10 μ in length, the latter becoming detached and germinating in turn by the

production of a slender germ-tube at either end or both. Viable chlamydospore-like elements, similar to those described by Brentzel from the United States [ibid., v, p. 366], were also detected in the present studies intermingled with the pycnospores both from old cultures and from diseased stems, seeds, and boll tissue.

Seed infection by the formation of mycelium and pycnidia in the seed coat was demonstrated for the first time, the pathogen apparently passing from the sepals to the pedicel, thence to the placenta, and reaching the seed through the funicle. Sections through diseased seeds revealed pycnidia exclusively in the immediate vicinity of the hilum. The pycnidium was found to arise as a stroma between the round cells and the fibrous layers of the seed coat, pushing the former outwards as it expands so that they lie along the pycnidial wall. The epidermal layer, permeated by the mycelium, is finally penetrated by the enlarging pycnidium. There was no conclusive evidence of invasion through the fibrous layers of the seed coat, and no trace of damage to the endosperm or cotyledons; hence, no doubt, the normal germination even of heavily infected seed.

When seed from infected bolls was placed in a germinator at room temperature, 80 per cent. germinated of which 20 per cent. developed pycnidia of *S. linorum* on the coats. A fortnight later half the infected seedlings showed cotyledonary lesions, on which pycnidia were subsequently formed. In another test 100 seeds from the same source as the foregoing were sown in a pot of sterilized soil under glass, and three weeks later two of the 92 per cent. that germinated showed typical lesions on the cotyledons; in another three days two more seedlings were similarly affected, and in due course pycnidia developed on all the spots, leaving no doubt as to the origin of infection in the seed.

The possible modes of overwintering of the pasmo fungus are discussed. In the writers' opinion initial outbreaks of the disease in Eire are attributable mainly to the presence of mycelium and pycnidia in the seed coat.

FULLER (W. H.) & NORMAN (A. G.). **Biochemical changes involved in the decomposition of Hemp bark by pure cultures of fungi.**—*J. Bact.*, l, 6, pp. 667–671, 1945.

At the Iowa Agricultural Experiment Station the rate of decomposition and biochemical changes in hemp bark inoculated with pure cultures of *Alternaria*, *Hormodendrum*, *Fusarium*, *Phoma*, *Trichothecium roseum*, and *Cephalosporium* [*R.A.M.*, xxiv, p. 191], all dominant fungi on field-rotting hemp, were investigated after incubation periods of 5, 10, and 20 days. During the first ten days, the several organisms caused roughly equal losses in total weight, but subsequently *Alternaria*, *Cephalosporium*, and *Fusarium* were the most active agents of decomposition. Both polyuronide and pectin were vigorously attacked during the first five days, but there was little disorganization of cellulose until the later stages, *Cephalosporium* being somewhat more aggressive in this respect than the other fungi under observation, with a residue of 52·3 gm. per 100 gm. original unretted bark after 20 days as against 54·6 to 59·1 for the remaining organisms and 72·1 for the uninoculated control samples.

[This information is also presented in *Res. Bull. Ia agric. Exp. Sta.* 344, pp. 940–942, 1946.]

REICHERT (I.). **Palestine. Diseases of ornamental plants.**—*Int. Bull. Pl. Prot.*, xiv, 10, pp. 181 M–192 M; 12, pp. 229 M–238 M, 1940. [Received July, 1946.]

This is a preliminary list, in the compilation of which the author was assisted by M. CHORIN, G. MINZ, J. PERLBERGER, and F. LITTAUER, of the fungal, bacterial, non-parasitic, and undetermined diseases of ornamental plants in Palestine, studied at the Agricultural Research Station, Rehovot, from 1923 to 1938.

Servazzi (O.). **Brevi note su alcune non communi malattie fungine di piante ornamentali.** [Brief notes on some uncommon fungal diseases of ornamental plants.]—*Boll. Lab. sper. R. Ossv. Fitopat., Torino*, xviii, 1–4, pp. 86–112, 3 pl., 1942. [Abs. in *Neuheiten PflSch.*, xxxvi, 2–3, p. 48, 1943. Received March, 1946.]

The following are unusual records of parasitic fungi on ornamentals in Italy: *Colletotrichum trichellum* var. *araliae* n.var. on *Aralia sieboldii*, *Hyalopsora polypodii* on *Cystopteris fragilis*, *Ascochyta hydrangeae* on hortensia [*Hydrangea hortensis*], *Diplodia rehmii* on *Pelargonium* spp., *Phyllosticta ocellata* and *Cladosporium elegans* on citrus trees, *Phoma pinoggii* n.sp. on *Gypsophila paniculata*, *Microdiplodia palmarum* on *Kentia forsteriana*, *Phyllosticta westendorpii* on *Mahonia* [*Berberis*] *japonica*, *P. goritiensis* on lilac, *Coniothyrium pallido-fuscum* on *Araucaria excelsa* var. *robusta*, *P. latifoliae* on *Kalmia latifolia*, *Phomopsis aucubae* f. *ramulicola* on *Aucuba japonica* var. *foliis variegatis*, *Macrophoma turconii* n.comb. on *Monstera deliciosa*, *Pirostoma farnesianum* on *Pandanus veitchi*, and *Gloeosporium polymorphum* on *Dracaena hookeriana* var. *latifolia*.

Goidànich (G.). **La 'Microsphaera polonica' Siem. nel Lazio.** [*Microsphaera polonica* Siem. in Lazio.]—*Boll. Staz. Pat. veg. Roma*, N.S., xxi, 2, pp. 161–174, 1 pl., 5 figs., 1941. [Received June, 1946.]

Microsphaera polonica, in its conidial state (*Oidium hortensiae*), was first recorded in Italy in 1932 [*R.A.M.*, xviii, p. 458; cf. above, page 438], in a glasshouse near Florence, on hydrangeas imported from Belgium, and probably infected in their country of origin. In 1934 the conidial stage occurred in glasshouses at Pinerolo and Turin, and in 1936–7 it was found near Florence on outdoor hydrangeas. The author observed it on forced hydrangeas in a glasshouse in Rome in the winter of 1939, and on glasshouse and outdoor hydrangeas throughout 1940. A feature of the 1940 outbreak was that among hundreds of affected glasshouse plants, while the flowers were severely attacked, the leaves showed little or no infection, only a few small spots being present, with few or no conidia. On the outdoor plants, on the other hand, leaf infection was of average severity. In the author's material, the conidia measured 16 to 45 by 12 to 19 μ. At the date of writing, the perfect state, *M. polonica*, has not yet been reported in Italy. The most susceptible varieties, locally, appear to be Altona, Amburgo, and Europa, while Ulrich, Seidel, and Deutschland are less severely affected.

Cochrane (V. W.). **The common leaf rust of cultivated roses, caused by Phragmidium mucronatum (Fr.) Schlecht.**—*Mem. Cornell agric. Exp. Sta.* 268, 39 pp., 9 graphs, 1945.

In studies on rose leaf rust (*Phragmidium mucronatum*) [*R.A.M.*, xxiv, p. 510], experimental inoculations with a single-uredospore clone of the fungus isolated originally from Hybrid Tea roses from California gave positive results on *Rosa setigera*, *R. carolina*, *R. virginiana*, *R. kamtchatica*, *R. blanda*, and *R. californica*.

The temperature limits for uredospore germination were 6° and 28° C., for aecidiospores 6° and 27°, and for teleutospores 6° and 25°. The optimum range for percentage and rate of germination for uredospores and aecidiospores was 15° to 21°, germ-tube growth being greatest at 18°, which was also the optimum for teleutospore germination.

Evidence was obtained by four different methods indicating that aecidiospore and uredospore germination and infection by uredospores can occur only in the presence of liquid water. Uredospore infection occurred from 9° to 27° (optimum 18° to 21°). Rose plants inoculated with uredospores and kept at 18° in a

moisture-saturated atmosphere for four hours developed some infection, 12 hours permitting the highest degree.

Outdoors, uredospores in lesions on infected leaves showed a maximum longevity of 49 days in the warm, rainy seasons (spring, summer, and autumn), and one of 70 days in winter, indicating that, probably, they do not overwinter at Ithaca, New York. Under controlled conditions of temperature and relative humidity, the longevity of uredospores on stored leaves was greatest at humidities of 25 to 75 per cent. and at a temperature of 3°; the maximum longevity (over 365 days) of detached uredospores occurred at 3° and humidity of 25 per cent. Humidity showed its greatest effect on survival between 12° and 27°. At −15° the life of the uredospores did not exceed 56 days. On agar, uredospore longevity ranged from 18 days at 3° to 30 minutes at 36°, while on wet leaves uredospores exposed to 27° were nearly all dead after 24 hours. Age of the leaf did not appear to affect susceptibility. It was found that uredospores cause infection only on leaves, penetration occurring only through the lower surface. Sporidia, however, produced aecidial lesions on both leaves and young stems.

It would seem that the reason the disease is not serious in the eastern United States is the combined effect of the cold winter and the hot midsummer. The short life of the uredospores makes the survival from one growing season to another dependent on the teleutospores. It is postulated that the prevalent high temperatures from June to September slow down the spread of the rust but do not eliminate well-established infections.

In southern California, temperature conditions are uniformly favourable to the disease. Here the decisive environmental factor is, probably, the amount and distribution of rainfall, dew and fog being of some importance during months of low rainfall. As winter defoliation remains incomplete, susceptible leaves are present at all times. The uredo stage is probably the chief source of inoculum in spring.

Baker (K. F.) & Thomas (H. Earl). **Failure of bud and graft unions of Rose induced by Chalaropsis thielavioides.**—*Phytopathology*, xxxvi, 4, pp. 281–291, 2 figs., 1946.

These writers' preliminary account of the failure of rose bud and graft unions caused by *Chalaropsis thielavioides* in California [*R.A.M.*, xxi, p. 19] has been amplified, and the following additional items of information may be noted. Strong circumstantial evidence is available for the spread of the pathogen on the hands or clothing of workers and on the budding knife. It survives in the soil or on buried plant residues for nearly a year. Graft failures may be avoided by the use of budded roses, healthy rootstocks, sanitation of tools, frames, and the like, and chemical treatment of the stems before grafting where the importance of the disease warrants it. Bud failures, which are rare, are preventable by immediate planting of cuttings or storage at 0° C. if delay is necessary, rotation with an immune crop, use of immune Ragged Robin rootstocks, high budding into canes later converted into cuttings, and precaution against spread by workmen. Chemical treatment of the cut surfaces was injurious to the host tissues.

Marchionatto (J. B.). **Argentine Republic. Tulip fire 'Botrytis tulipae', a disease new to the country.**—*Int. Bull. Pl. Prot.*, xv, 7–8, p. 133 m, 1941. [Received July, 1946.]

Studies on tulip fire (*Botrytis tulipae*) [*R.A.M.*, xxi, p. 139; xxiv, p. 231] first discovered in the Argentine Republic by Maria D. Campi showed that when the soil is inoculated with the mycelium and sclerotia of the fungus the bulbs are attacked; resting spores formed in the bulbs transmit the disease from one crop to another. Brief directions are given for the control of the disease.

Gregory (P. H.) & Gibson (G. W.). **The control of Narcissus leaf diseases. III. Sclerotinia polyblastis Greg. on Narcissus tazetta var. Soleil d'Or.**—*Ann. appl. Biol.*, xxxiii, 1, pp. 40–45, 1946.

The object of these experiments at the Scilly Isles Experiment Station, St. Mary's, was to determine the possibility of using Bordeaux mixture for the control of narcissus fire (*Sclerotinia polyblastis*), the chief fungus disease of *Narcissus tazetta* varieties, which are grown commercially in the open in south-west England. During the seasons 1937 to 1941, Bordeaux mixture (4–4–40) with a wetting agent, usually agral II at 6 oz. per 40 gals. [*R.A.M.*, xxiii, p. 449], was applied at the rate of 120 gals. per acre on one commercial field and on small plots of the Soleil d'Or variety. One or two sprays were given annually, the first after flower-harvesting, and the second, when possible, about a month later.

The number of flowers picked on sprayed plots showed an average increase for the three seasons of 26 per cent. and increased bulb weight of 35 per cent. over the controls. The sprayed plots maintained a higher general level throughout the experiments, although the benefits recorded in any one year appear to have been exhausted in the promotion of increased flowering the year after. An average addition of one 'bell' to the inflorescence is regarded as evidence of better quality due to the treatment, and the total number of bulbs of flowering size was increased by about 15 per cent. in 1941 after only one post-flowering spray had been applied the previous year.

No marked retardation of anthesis was noted, as had been found for Golden Spur [ibid., xx, p. 206]. This method of controlling *S. polyblastis* wherever prevalent is, therefore, recommended for the Soleil d'Or variety as likely to increase production without delaying flowering.

Pape (H.). **Fäulnis bei Calla-Ursache und Bekämpfung.** [*Calla* rot—cause and control.]—*Blumen- u. PflBau ver. Gartenwelt*, xlvii, 20, pp. 235–236, 1943. [Abs. in *Neuheiten PflSch.*, xxxvii, 2, p. 42, 1944. Received March, 1946.]

Bacillus [*Erwinia*] *aroideae* and *B. carotovorus* [*E. carotovora*] were identified as the agents of a rapidly destructive soft rot of *Zantedeschia aethiopica* [*R.A.M.*, xx, p. 451] in Germany, which may originate in infested soil or on bulbs from abroad and be disseminated in the process of watering. The decay extends upwards from the site of invasion, just below soil-level, to the leaves and pedicels and downwards to the bulb. Control measures should include stringent sanitation and steam or formalin sterilization of the soil before planting with new bulbs.

Pape (H.). **Die Sclerotinia-Stamm- und Blattfäule der Gloxinien.** [The *Sclerotinia* stem and leaf rot of Gloxinias.]—*Blumen- u. PflBau ver. Gartenwelt*, xlvi, 14–15, p. 86, 3 figs., 1942. [Abs. in *Neuheiten PflSch.*, xxxv, 1–2, p. 14, 1946.]

Sclerotinia sclerotiorum attacks gloxinias planted out in the greenhouse for corm production towards the end of the growing period, when the dense vegetation promotes the spread of the pathogen. Symptoms of the disease include wilting of the plants in groups and a soft rot of the stems, petioles, pedicels, and the adjoining areas of the leaf blade, which are covered with the white, flocculent mycelium of the fungus, bearing the pea-sized, grey to black, sessile sclerotia. These organs fall to the ground, where they may persist for years, being highly resistant to cold and drought, before producing apothecia. The corms are not infected but suffer from the premature decay of the aerial system. Control may be effected by the use of formalin-sterilized soil, wide spacing, avoidance of excess humidity, and irrigation of the gaps left by the removal of diseased plants with a solution of 1 to 2 per cent. uspulun or of 30 gm. copper carbonate+0·3 l. commercial sal volatile in 10 l. water.

LEPIK (E.). **Spread of Snapdragon rust in Europe.**—*Int. Bull. Pl. Prot.*, xv, 5, p. 93 M, 1941. [Received July, 1946.]

Antirrhinum rust (*Puccinia antirrhini*) [*R.A.M.*, xxiii, p. 80; xxiv, pp. 475, 476] is stated to have become common in central and western Europe. In 1937 it was observed simultaneously in Leningrad, the Caucasus, Odessa, and Voronezh, though quarantine measures had been taken against it and the import of snapdragon seed was virtually nil.

GRÉEN (S.). **Peronospora antirrhini (Schroet.) första gången påträffad i Sverige.** [*Peronospora antirrhini* (Schroet.) encountered for the first time in Sweden.]—*Agri. Hort. Genet.*, i, 3–4, pp. 97–98, 1943. [German and English summaries. Received July, 1946.]

In a greenhouse at the Weibullsholm Plant Breeding Institute, Landskrona, in January, 1943, the writer detected the mildew *Peronospora antirrhini* on snapdragon (*Antirrhinum*) [*majus*: *R.A.M.*, xxiv, 451], this being the first record of its occurrence in Sweden. A new variety, *Antirrhinum* No. 1174, proved to be resistant to the pathogen. The wild alternate host, *A. orontium*, does not occur in the surrounding country, so that the origin of the sporadic outbreak remains obscure for the present.

BONTEA (VERA). **La flétrissure de l'Aster sinensis L. (syn. Callistephus sinensis Neer.).** [Wilt of *Aster sinensis* L. (syn. *Callistephus sinensis* Neer.).]—*Bull. Sect. sci. Acad. roum.*, xxv, pp. 179–184, 1942. [Abs. in *Neuheiten PflSch.*, xxxvii, 5, p. 166, 1944. Received March, 1946.]

China asters, particularly the white varieties, sustained heavy damage in Rumania in 1938 and 1942 from the wilt disease caused by *Fusarium oxysporum* f. 6 [*R.A.M.*, xvii, p. 247], the losses in some cases amounting to 50 per cent. of the crop. In regions with a warm, humid summer climate, and where liberal applications of nitrogenous manures are given, the reduction in stand may rise to 80 per cent., elsewhere it is commonly round about 30 per cent. Lime- or phosphorus-containing fertilizers should therefore be substituted for nitrogen and peat for compost. Essential precautions are soil sterilization and half an hour's immersion of the seed in 0·25 per cent. uspulun or the same period in water heated to 35° C., followed by another 30 minutes in 0·1 per cent. mercuric chloride.

HEY (A.). **Die wichtigsten Krankheiten und Schädlinge im Samenbau der Kleeartigen Pflanzen.** [The most important diseases and pests in relation to seed production by plants of the Clover family.]—*Veröff. GemeinschArb. Forsch-Dienst. Reichsverb. PflZucht*, iii, 8, 139 pp., 45 figs., 3 diags., 1945.

This useful compendium contains the available information on the symptoms, effects, and control of a number of diseases responsible for reductions in the seed crops of various Leguminosae in Germany [*R.A.M.*, xxiii, p. 22], either by (1) weakening the plants, (2) causing their partial or total dying-off, or (3) directly attacking the inflorescences and fructifications. Group (1) includes the bean and pea mosaic viruses on clovers and the lucerne mosaic virus on its own host; the rusts, e.g., *Uromyces trifolii* and its vars. *hybridi* and *repentis* on red, alsike, and white clovers, respectively; *U. anthyllidis* on wound clover (*Anthyllis vulneraria*); *U. onobrychidis* on sainfoin (*Onobrychis sativa*); *U. flectens* on white, strawberry (*Trifolium fragiferum*), alsike, and crimson clovers; *U. striatus* on *Medicago lupulina* and more rarely on lucerne; and *U. euphorbiae-corniculatae* on *Lotus corniculatus* and *L. uliginosus*, the two last-named rusts being heteroecious, with their aecidial stages on *Euphorbia cyparissias*; sooty blotch (*Dothidella cymadothea*] *trifolii* [ibid., xiv, p. 367] on red, white, and alsike clovers and *T. medium*;

Pseudopeziza trifolii on red, white, and alsike clovers, *A. vulneraria*, and *L. corniculatus*, and *P. medicaginis* on lucerne and *M. lupulina*; leaf spots, including *Macrosporium* [*Stemphylium*] *sarciniforme* on red clover and lucerne, occasionally affecting crimson clover; downy mildews caused by *Peronospora aestivalis* on lucerne and less frequently on *M. lupulina*, *P. pratensis* on red and crimson clovers, *P. trifolii-hybridi* on alsike, *P. meliloti* on *Melilotus* spp. [all these species are often called *P. trifoliorum*], and *P. lotorum* on *L.* spp.; the true mildew, *Erysiphe martii* [*E. polygoni*], with its formae speciales on red, alsike, and crimson clovers, and to a lesser extent on white clover, *A. vulneraria*, *O. sativa*, *L.* spp., and *M.* spp. and *E. pisi* f.sp. *medicaginis* on lucerne, *Medicago media*, and *M. falcata*; and crown wart of lucerne (*Urophlyctis alfalfae*) and of red, white, and alsike clovers and *L. corniculatus* (*U. trifolii*).

Representatives of group (2) include the damping-off fungi, notably *Pythium debaryanum*, chiefly affecting lucerne but also pathogenic to crimson clover and most of the other *T.* and *L.* spp.; violet root rot (*Helicobasidium crocorum*) on lucerne, different kinds of clover, *M. lupulina*, and serradella (*Ornithopus sativus*); another root rot, caused by *Thielavia* [*Thielaviopsis*] *basicola* on red and crimson clovers and *Onobrychis sativa*; clover rot (*Sclerotinia ciborioides*) [*S. trifoliorum*], the agent of intensive damage, especially to red and crimson clovers and *M. lupulina* [ibid., xxiii, p. 22]; and anthracnose of red and crimson clovers due to *Gloeosporium caulivorum* [*Kabatiella caulivora*], and of lucerne and *Ornithopus sativus* caused by *Colletotrichum trifolii* [ibid., xxii, p. 314].

Group (3) includes the last-named and *Botrytis anthophila*, which converts the anthers of red clover into a grey, pulverulent mass without inducing any symptoms in the rest of the plant. It predominates in eastern Europe, more especially in Poland, the Baltic Provinces, and the U.S.S.R. [ibid., xix, p. 415].

A bibliography of 76 titles and a key for the determination of the diseases and pests are appended.

SCHENKER (P.). **Kleekrebspilze.** [Clover canker fungi.]—*Mitt. naturf. Ges. Bern.*, N.F., iii, pp. xxiv–xxv, 1946.

(*Sclerotinia trifoliorum*) [see preceding abstract] was the principal agent of winter-killing of red clover in Swiss experimental plots in 1944; of the two other fungi causing similar symptoms, *Typhula trifolii* was represented by numerous fructifications but only two specimens of *Mitrula sclerotiorum* [*R.A.M.*, xviii, p. 299] were detected. The isolated lucerne plants growing up among the clover remained free from infection.

MAIER (W.). **Über das Vorkommen einer Bormangelkrankheit der Äpfel in Deutschland.** [On the occurrence of a boron deficiency disease of Apples in Germany.] —*Phytopath. Z.*, xiv, 5, pp. 613–628, 13 figs., 1944. [Received August, 1946.]

The symptoms of a disease of Osnabrück Renette apple fruits in the Ulm district of Germany investigated by the author in 1940 were characteristic of 'drought spot' [internal cork], as described by McLarty from Canada [*R.A.M.*, xix, p. 603]. They included, in an early stage of fruit development, the brown discoloration and necrosis of large portions of the flesh or the occurrence in the latter of numerous pit-like, brown, necrotic areas. In both cases the fruits were abnormally small, with dark depressions in the skin, and a bumpy or irregular, undulating surface. Another form of the disorder was manifested by necrosis of the tissues surrounding the core, while some of the fruits were malformed, with deep fissures and cracks and scabby skin.

Numerous analyses revealed a substantially lower boron content in the diseased as compared with the sound fruits (10 to 25 and 40 to 150 mg. per kg. dry matter, respectively). The incidence of the trouble was reduced from 76·3 to 1·5 per cent.

in 1940 and 1941 by the injection of boric acid and borax (liquid and solid) [in unspecified quantities] into the branches of affected trees. In other tests from 1941 to 1943, borax, in powder form in the first two years and as sludge in the third, was inserted into the soil at a depth of 30 to 40 cm. at the rates of 500, 250, and 1,000 gm. in the three successive years for a large tree and at 250, 250, and 600 gm. for a smaller one, resulting in a reduction of drought spot from between 34 and 70 per cent. to nil.

STAHEL (M.). **Die Krebskrankheit unserer Obstbäume, ihre Ursachen und Bekämpfung.** [The canker disease of our fruit trees, its causes and control.]—*Schweiz. Z. Obst- u. Weinb.*, lv, 15, pp. 285–291, 5 figs., 1946.

Nectria galligena is widespread in Switzerland, about a third of the apple varieties listed in a new book by H. Kessler, 'Die Apfelsorten der Schweiz', being described as susceptible to the disease. Cultural practices indirectly predisposing the trees to infection include the excessive use of stable manure and unduly drastic pruning, both of which promote a luxuriant growth habit detracting from winter-hardiness and enabling the pathogen to enter the host through cortical fissures due to frost. Susceptibility to cold is also enhanced by heavy, impermeable, water-logged soils, notably in the Berner Rose, Sauergrauech, Golden Pearmain, Ontario, and Champagne varieties. In an orchard on ground of this description the writer in 1945 observed no essential difference between the symptoms on the Bohn and Aargauer Jäger varieties, which are classed as slightly and very highly susceptible, respectively. However, an examination of cankers of comparable age and size on both varieties revealed only scattered perithecia on Bohn, whereas on Aargauer Jäger they were so densely clustered as to impart a red sheen to the infected parts.

In addition to rational cultural practices, the most important control measure is the use of resistant stocks for grafting.

N. galligena is occasionally found on pears [*R.A.M.*, xxv, p. 399] and more rarely still on stone fruits.

MOORE (M. H.). **Improving the field performance of standard protective fungicides. I. The place of spreaders in the spray programme for Apple trees.**—*J. Pomol.*, xxii, 1–2, pp. 76–91, 1946.

The author describes a series of experiments undertaken during the period from 1932 to 1944. They were designed to test the effect of combining insecticidal and fungicidal sprays for the control of apple scab [*Venturia inaequalis*] and sawfly [*Hoplocampa testudinea*] and to reconcile the two different types of spraying; that is, the heavy insecticidal spray with a low surface-tension spreader which gives a thorough drenching of the tree, and the protective fungicidal application, which demands a concentrated spray fluid of high surface tension, dispersing in fine, misty drops and possessing good adhesive properties.

The general conclusions arrived at were that heavy spraying was superior to light spraying for scab control but it caused more damage, which could be reduced by decreasing concentrations of lime-sulphur. The use of a spreader with lime-sulphur gave improved control in one experiment only when a heavy application was made where infection had already started. The reduction in spray damage obtained when a spreader is used can be secured more economically by using more dilute lime-sulphur. Effective control of *V. inaequalis* has been obtained with as low as 1 per cent. for pre-blossom applications [*R.A.M.*, xvi, p. 765; xviii, p. 461], but a precisely timed and thorough application is required, and lead arsenate must not be incorporated. Not more than a fortnight should be allowed to elapse between applications so that constant protection is afforded.

Bordeaux mixture is not satisfactory for apples and the addition of spreaders in general proved damaging. The improvement in the fungicidal efficacy of colloidal

sulphur observed when a spreader was used does not appear to be great enough to warrant the increased expenditure where high pressure is available and scab control is the sole object in view. Damage from heavy applications is unlikely where colloidal sulphur is used alone, except for sulphur-susceptible varieties.

It is concluded that there is no objection to applying fungicides and contact insecticides together in the same spray with a good spreader. However, adequate pump capacity and high pressure should make a spreader unnecessary, although desirable perhaps in exceptional cases. It was noted that the use of ester salts and sodium B sulphonates with lime-sulphur, and of soap solution with colloidal sulphur, caused damage, and the fungicidal value of lime-sulphur was reduced by gelatine. Soap may be regarded as superseded by several of the new textile wetting agents, which are both efficient spreaders, easily prepared, and compatible with fungicides.

Khristov (A.). Принос към проучването на червените петна по сливата—**Polystigma rubrum (Persoon) de Candolle.** II. Условия за узряване на стромите на паразита и възможности за прилагание на културни марки срещу болестта. [Studies of red leaf spot disease of Plum—*Polystigma rubrum* (Persoon) de Candolle. II. Conditions governing stromatal development of the pathogen and the use of cultural methods in combating the disease.] —*Земедел. Наук.*, *България* [*Agric. Sci.*, *Bulgaria*], i, 2, pp. 23–32, 1946.

In this study of the red leaf spot disease of plums (*Polystigma rubrum*) [*R.A.M.*, xvi, p. 392], the author found that premature abscission of the leaves, due to acute infection, depressed the vitality of the stromata and influenced the degree of infection during the following growing season. Stromata which have not overwintered do not mature; 10 weeks' low-temperature humidity is required for their full development. Ploughing-under of the fallen leaves does not kill the stromata, which will mature in early spring and induce infection if exposed on the surface of the soil by the next ploughing. If, however, they remain buried, they die before spring. Therefore, orchards ploughed during the dormant season should not be re-ploughed during the following growing period. Lime amendments to orchard soil had no effect on the stromata, but sulphur, stable dung, or potassium fertilizers impaired their vitality. Treatment with bonemeal or green manure contributed to eliminate stromata from the subsoil. Stromata wintering on the soil surface are weakened by foliage sprays of 1 per cent. Bordeaux mixture, iron sulphate, or 10 per cent. sulphur solution, applied in autumn before leaf-fall, and subsoil stromata are killed. One per cent. borax is lethal even to those on the surface. The ascospores being the sole source of infection, such treatments should reduce the incidence of the disease considerably in the following season.

Goidànich (A.). **Interpretazione simbiotica di una associazione mico-entomatica gallare.** [Symbiotic interpretation of a myco-entomogenous gall association.] —*Atti Accad.*, *Torino*, lxxvi, 2, pp. 208–221, 3 figs., 1941. [Received July, 1946.]

Ischonyx pruniperda (Cecidomyidae), which in the larval stage transforms into galls the reproductive and vegetative buds of plums, damsons, *Prunus spinosa*, *P. cocomilia*, and *P. myrobalana* [*P. divaricata*], has been found in a symbiotic association with a species of *Sphaeropsis*. The partnership is mutually beneficial, the insect receiving nutriment from the mycelium of the fungus, and the latter feeding on the wall of the gall; both form their reproductive stages simultaneously, the insect larva serving as a vehicle for the fungus in the production of a new gall. The third member of the association, the phanerogamic host, is the only one to sustain injury.

WILLISON (R. S.). **Peach blotch.**—*Phytopathology*, xxxvi, 4, pp. 273–276, 1 fig., 1946.

'Blotch' is the name assigned to a mosaic-like condition observed in 1940 on a single three- to four-year-old peach tree of an unknown large-flowered variety in a two-square-mile block near Winona, Ontario. The variegations consisted of well-defined, pale to yellowish-green areas of variable size and shape, ranging from numerous angular spots scattered over the leaf blade to larger, usually fewer, irregular blotches. A few leaves showed chlorosis along the larger veins only, and in some cases the margins were ragged as a result of marginal scorch.

In transmission trials by the double-budding inoculation technique [*R.A.M.*, xxiv, p. 197], using peach, myrobalan (*Prunus cerasifera*) [*P. divaricata*], and *P. mahaleb* as stocks, Elberta and Rochester were the most susceptible of the peach varieties tested. The symptoms on the former closely resembled those on the original tree, while the latter developed a quasi-symmetrical chlorotic blotch centred about and extending along the midrib and tending to feather out along the lateral veins. Vedette showed slight blotching in some seasons, while in others little or no trace of the disorder was apparent. Golden Jubilee was practically symptomless, apart from a mild mosaic pattern or veinal chlorosis. The white-fleshed Peregrine variety, imported from England, was likewise virtually free from outward manifestations of the disease. The markings on all varieties were either pale green, yellowish-green, or greenish-yellow, never white, and no signs of infection were observed on the flowers or twigs.

The results of two seasons' transmission experiments on plums, apricots, and cherries were uniformly negative, except for one case of doubtful and indeterminate symptoms on an Italian prune.

In 1944, sucker growth near the crotch of a Marigold peach near Hamilton, Ontario, developed blotch symptoms predominantly of the central, symmetrical, feathery type, this being presumably the second spontaneous occurrence of the disorder. Transmissibility was demonstrated by the inoculation of peach seedlings, but the effects of the virus on other hosts have yet to be investigated. Another problem requiring further elucidation is the interrelationship, if any, between blotch and two rather similar disturbances, mottle and calico [ibid., xxi, p. 27; xxiv, p. 65].

LOUW (A. J.). **Green rot of Apricots.**—*Fmg. S. Afr.*, xxi, 5, pp. 308, 312, 1946.

A green rot of apricots, now reported from the south-western districts of the Cape Province, where it has not been encountered hitherto and which, while familiar for many years in western Cape Province, has apparently not been recorded in the literature, causes decay of the fruit, usually originating from the calyx end, where the old sepals of the blossom adhere to the fruit. A white mould develops on the surface, the fruit ultimately shrivels, and becomes gummed to the twig unless it abscisses prematurely.

The disease is stated to be of fungal origin [unspecified], occurring sporadically, and has not occasioned serious loss hitherto in the winter-rainfall area. The present sudden and virulent outbreak is attributed to heavy rains last September and October and districts west of the south-western area of the Province escaped it, apparently owing to strong, dry, south-east winds which passed over them at that time.

Year-old twigs are also attacked by the fungus, which causes gum to exude freely and a die-back of the tips. The twigs are thought to constitute the chief source of infection. Care should be taken not to confuse the symptoms of gum exudation with similar symptoms associated with other apricot diseases, such as gum spot, in which the spots are plainly delineated on the shoots, fruits, and leaves, or the physiological accretions of gum on the older branches of apricot trees.

The following measures are recommended for the control of the disease: removal and burning of infected twigs and mummified fruits at pruning-time with a view to preventing the overwintering of the causal pathogen; spraying with 4–4–50 Bordeaux mixture when the buds begin to swell, but before exposure of any parts of the blossoms or leaves; and with 2–2–50 at about 75 per cent. petal-drop, with a repetition at the same concentration a fortnight after.

Prentice (I. W.) & Harris (R. V.). **Resolution of Strawberry virus complexes by means of the aphis vector Capitophorus fragariae Theob.**—*Ann. appl. Biol.*, xxxiii, 1, pp. 50–53, 1 pl., 1 diag., 1946.

The authors describe experiments to determine whether the frequent association of crinkle with yellow edge or with xanthosis (possibly identical with the latter) in strawberry plants [*R.A.M.*, xxi, p. 380] is obligate or fortuitous [see next abstract]. As strawberry viruses are not sap-transmissible, nor present apparently in expressed sap, have few known vectors, and a very limited host range, a method has been devised for separating the component viruses from mixtures present in the plants based on their differential persistence in the aphid vector (*Capitophorus fragariae*). Virus-free aphids after fasting for 18 hours, although prefasting was later found to have no effect [cf. ibid., xvii, p. 344], were placed on detached leaves of Royal Sovereign plants infected with mild or severe crinkle or yellow edge. After feeding periods of two minutes, one hour, or 24 hours, two aphids were transferred to each of several young virus-free wild strawberry (*Fragaria vesca*) plants, and retransferred to similar plants after 10 minutes, two hours, and 24 hours. Chlorotic speckling, distortion, and dwarfing of the leaves were observed some three weeks later only on plants infected by aphids having a 24-hour feed. Royal Sovereign plants, whether infected by direct aphid transfer or by grafting to infected *F. vesca* plants, developed only insignificant chlorotic spotting and sometimes showed no symptoms at all, so that infection had to be confirmed by grafting to healthy wild strawberry plants.

The symptoms from all three sources of infection were similar and identical with those of mild crinkle as described by Harris and King and the virus thus selectively transmitted is provisionally regarded as mild crinkle virus. Transmission occurred after feeding periods of one hour or more and the virus did not usually remain in the vector for more than three hours.

Prentice (I. W.). **Resolution and synthesis of virus complexes causing Strawberry yellow-edge.**—*Nature, Lond.*, clviii, 4001, pp. 24–25, 1946.

Feeding experiments with aphids (*Capitophorus fragariae*) [see preceding abstract] have brought about the isolation of a non-persistent virus which is believed to be mild crinkle virus. Further experiments in which the aphids, after feeding for ten days on yellow edge-infected Royal Sovereign plants, transferred to uninfected plants of *Fragaria vesca* for 24 hours and again to similar plants 24 hours later, produced in the second set of plants chlorotic spotting and slight leaf-cupping. This virus, which persists in the vector for several days, transferred to healthy Royal Sovereign plants causes very mild yellow-edge symptoms and is called provisionally the 'mild yellow edge virus'. The grafting of a Royal Sovereign plant with mild crinkle to one containing mild yellow edge induced severe yellow edge in both. Thus, it appears that yellow edge is due to the combined action of two viruses, the persistent one being, apparently, different from the more persistent of two viruses isolated by Wood and Whitehead (in the Press) from plants affected with severe crinkle. The author also has isolated a persistent virus, probably identical with this, from plants with severe crinkle. The combination of this virus with mild yellow edge also produces severe yellow edge. Therefore two different types of yellow edge have been synthesized by the combination of the mild

yellow-edge virus with either the mild crinkle virus or with the severe crinkle virus.

PRENTICE (I. W.), KING (MARY E.), & HARRIS (R. V.). **Experiments on virus degeneration of Huxley Strawberry.**—*J. Pomol.*, xxii, 1–2, pp. 111–116, 1 pl., 1946.

The grafting of two healthy Huxley strawberry plants to Royal Sovereign plants infected with yellow edge and crinkle at East Malling Research Station in 1938 was followed by loss in size, vigour, and leaf lustre of the plants and a progressive chlorosis of the younger leaf margins—symptoms of a condition popularly known among growers as 'degeneration'. The disease thus resembles yellow edge [*R.A.M.*, xii, p. 519, and preceding abstracts], but Huxley has been shown to be tolerant of yellow edge, and acts as a symptomless carrier [ibid., xxi, p. 379]. A similar condition has been noted on the Oberschlesien and Madame Lefebvre varieties.

Grafting experiments showed that symptoms of degeneration were induced in clones of Huxley infected with yellow edge and mild crinkle by grafting them to Royal Sovereign also infected with yellow edge and mild crinkle, suggesting the passage of a virus or viruses from the latter variety to the former. Evidence from a small number of grafts indicated that degeneration is not caused by mild crinkle.

In further field experiments Huxley plants grafted to degenerate Huxleys became degenerate and those grafted to vigorous remained vigorous. Degenerate Huxleys induced symptoms of yellow edge in Royal Sovereign plants but the symptoms were no more severe than those induced by one of the vigorous Huxley clones (infected with yellow edge of moderate severity). The relationship between degeneration in Huxley to yellow edge in Royal Sovereign is not clear, but it is considered unlikely that the virus or virus complex causing degeneration in Huxleys is distinct from the causal agent of yellow edge in Huxley or Royal Sovereign. Grafting of vigorous Huxley to Royal Sovereign plants already infected with yellow edge increased the severity of the symptoms.

The disease also has affinities with the stunting disease [ibid., xxi, p. 30], characterized by short, erect petioles, small, cupped leaves with a dull upper surface, and, occasionally, marginal chlorosis. The greenish-yellow chlorosis of degeneration may be confused with the yellower and more vivid chlorosis of *Verticillium* [*dahliae*], which is a common pathogen of Huxley and the mycelium of which can be easily isolated [ibid., xvii, p. 689].

Pending identification of the organism or organisms involved, it is recommended that runner beds of Huxley should be rogued for degeneration.

CHOWDHURY (S.). **Ceratostomella diseases of Pineapple.**—*Indian J. agric. Sci.*, xv, 3, pp. 135–139, 1 pl., 5 figs., 1945.

Of the three types of pineapple infection by *Ceratostomella paradoxa* [*R.A.M.*, xix, p. 663] in the Surma Valley and hill districts of Assam, namely, leaf spot, base rot, and fruit rot, the first-named was found, during a survey from 1940 to 1944, to cause negligible damage, while the other two were responsible for losses of 4 to 10 and 3 to 15 per cent., respectively. Fruit rot was particularly troublesome in transit and storage on the local Joldhup variety, the crop of which was occasionally reduced by over 50 per cent.; the imported Giant Kew and Queen were more resistant. The symptomatology, pathogenicity, morphological and cultural characters, and means of perpetuation and dissemination of the fungus are described.

CHOWDHURY (S.). **Heart or stem-rot of Pineapple.**—*Indian J. agric. Sci.*, xv, 3, pp. 139–140, 1 pl., 1945.

Heart or stem rot of pineapple (*Phytophthora parasitica*) occurs in a highly sporadic form in the Surma Valley and hill districts of Assam, some fields losing

7 to 25 per cent. of their plants from partial or complete destruction of the meristematic tissue and others none. The disease has not hitherto been reported on pineapple from any other part of India, though it is prevalent in other countries. The pathogenicity of the fungus was established by inoculation experiments. In addition to thorough drainage of the soil and the exclusive use of vigorous planting material, Mehrlich's recommendation in *Pine Quart., 1931*, 1, pp. 171–182, 1931 of immersion in Bordeaux mixture 1–1–3 before planting [cf. *R.A.M.*, xii, p. 304] gave satisfactory control.

DUBRISAY. **Propriétés et étude des produits mouillants. Théorie élémentaire du mouillage.** [The properties of and a study on wetting products. An elementary theory of wetting.]—*C.R. Acad. Agric. Fr.*, xxvii, 13, pp. 746–752, 1 fig., 1941. [Received August, 1946.]

The author discusses the phenomena of surface tension and their application to the testing and employment of wetting compounds.

RAUCOURT (M.). **Revue de phytopharmacie. VII^e^ série.** [Review of phytopharmacy. 7th series.]—Reprinted from *Ann. agron.*, 19 pp., 1943. [Received August, 1946.]

In this paper the author reviews and discusses, with numerous references to the relevant literature, recent advances in the study of insecticides and fungicides under the headings biological methods, sulphur and its derivatives, work on arsenicals, organic products of synthesis, and adjuvants. A list of 85 papers cited is appended. Practically all the work referred to on fungicides has been noticed from time to time in this *Review*.

MARSAIS (P.). **Toxicité du cuivre et mode d'action sur les parasites végétaux.** [The toxicity of copper and its mode of action on plant parasites.]—*C.R. Acad. Agric. Fr.*, xxviii, 2, pp. 162–169, 1942. [Received August, 1946.]

From a study of 70 papers printed before 1917 and 30 between that year and 1941, inclusive, the author summarizes under 10 headings the state of knowledge [at the date of writing] on the causes and mechanism of the toxicity to plant parasites of preparations containing copper.

The points dealt with are the following. (1) Copper, acting through the ions liberated from dissociated solutions, kills, in the form of its dissolved salts, at a dosage of 10^{-6}, the zoospores of mildew [? *Plasmopara viticola*] or, at least, prevents them from developing. In this form it breaks the life-cycle of the parasite. (2) In practice, the dosage adopted is about 10^{-2}. (3) The idea of the threshold of toxicity is somewhat shaken by the phenomena of adsorption. (4) It is only for copper that the toxic value of the insoluble salts has been studied; with the other metals, only the action of the soluble salts and that of salts in suspension have received attention. In any case, toxicity is related to the presence of free metallic ions, and, seemingly, to their valency and atomic weight. (5) The very toxic salts of silver, mercury, and copper are very soluble or highly dissociated. The copper salts present in the deposits left by mixtures, mostly insoluble, contain enough copper ions, which can be freed, to be toxic to the zoospore. Possibly, insoluble copper compounds act mechanically or physically on the zoospore. If the intervention of electrical phenomena is taken into account, consideration must be given to Delage's view that the copper ion, positively charged, is emitted by insoluble particles which are negatively charged. The peripheral zone of the zoospores, negatively charged, at first repels the particles, but finally attracts the ions and fixes them by adsorption. With the salts of mercury and silver, it is the free positive ions Hg and Ag which act; colloidal silver is much less toxic than

dissolved salts of silver, and is charged with negative electricity. Colloidal copper oxychloride is more fungicidal than the deposits from copper mixtures, and is positively charged. (6) A different explanation is given by Devaux: the surfaces of spores and plants are charged with positive electricity and attract free or semi-free, negatively charged molecules. (7) The aqueous part of plants is surrounded by the cell membrane; this membrane appears to attract the least hydrated part of the neighbouring free molecules; the copper salts of mixtures are much hydrated, and can be adsorbed by their metallic content. (8) It appears that a strong charge brought about by the electrolytes serves to establish the necessary relations between the living membranes and the copper particles, and this enables these particles to act, whether their charge is positive or negative. (9) The question arises whether the copper ions, if they are adsorbed, act chemically within the spores upon the metabolism of the plant-host. More information is required to clear up this point. (10) The meaning generally applied to the term 'toxicity' should be extended to include excess or deficiency of certain bodies, or electrical charges.

Ciferri (R.). **Recenti progressi italiani nel campo degli anticrittogamici.** [Recent Italian advances in the field of fungicides.]—*Atti Conv. agrar. italo-amer., 1946*, pp. 1–40, 1946.

In this paper, read at the Italo-American Agricultural Convention held at Florence on 25th to 29th January, 1946, the author reviews and discusses the researches carried out at the Centre of Fungicidal Studies, Pavia, during the late war. Laboratory tests of over 400 formulae containing 1 to 12 per cent. copper and of nearly 300 not containing copper, with field tests of about 100 of all these, showed that fungicides containing less than 8 per cent. metallic copper, whatever their composition, did not guarantee adequate control of an epidemic of average intensity of vine mildew (*Plasmopara viticola*). Certain materials containing 8 per cent. metallic copper showed a general fungicidal effect (and against *P. viticola* in particular) which was much greater than that of Bordeaux mixture with an equal content of the active metal (0·3–0·3–100) and sometimes approached that of Bordeaux mixture (1–1–100). Hence it appears that Bordeaux mixture (1–1–100) was not outclassed by materials manufactured during the war which contained one-third of this amount of copper. There is, however, hope that if the content of the active metal can be raised above 8 per cent. (presumably to between 12 and 16 per cent., corresponding to a copper content in Bordeaux mixture of between 0·3–0·3–100 and 0·6–0·6–100) without affecting the favourable characters of these products, when they should at least equal Bordeaux mixture 1–1–100.

As regards future studies, the most promising aspects are as follows. Among univalent fungicides, the best monometallic products are those having a copper base. Of these, the inorganic include the cuprobentonites and the improved cuproammoniacal sprays, while the organic include primarily cuprous products with a potentializing effect due to the addition of oxyquinolin derivatives and, secondarily, the cuprotartrammoniacal compounds. The polymetallic fungicides are those containing other metals beside copper, particularly iron and zinc, among the heavy metals. Among these may be mentioned the cupro-ferrocitric sprays, of which Casale's mixture [*R.A.M.*, xxii, pp. 52, 287] is the prototype, and the polymetallic bentonites, containing, in addition to copper, various other elements such as iron, magnesium, zinc, etc.

Among polyvalent fungicides mention should be made of the sulphocupric products containing polysulphides or colloidal, bentonite, or active sulphurs.

[This paper also appears in *Atti Ist. bot. Univ. Pavia*, Ser. 5, viii (1), pp. 1–40, 1946.]

Khristov (A.). Начин за домашно приготовление на колоидална сяра. [Directions for preparing home-made colloidal sulphur.]—*Земедел. Наук., България* [*Agric. Sci., Bulgaria*], i, 1, pp. 1–22, 1 pl., 1946.

A useful home-made colloidal sulphur spray can be prepared from two solutions, one consisting of 1 l. glue solution (10 to 20 per cent.) added to 10 l. water, plus 0·4 l. concentrated lime-sulphur solution at 23° Baumé, and the other 30 gm. ground potassium permanganate in 10 l. water; the latter solution is poured slowly into the first, which should be well stirred meanwhile. An addition of water to this mixture to make 50 l. produces a sulphur content of 1 in 500, the preparation having an alkaline reaction of pH $>$ 8·4, being pale ochre in colour and possessing good wetting and adhesive qualities. It should be freshly made to prevent aggregation of the sulphur particles, but 30 c.c. concentrated sulphuric acid, added until a milky-white solution is obtained, and having an acid reaction of approximately pH 4·2, as in the case of commercial sulphurs, will enable it to keep several days. Home-made colloidal sulphur proved as effective as lime-sulphur at 1 in 50 for spraying apple seedlings against mildew [*Podosphaera leucotricha*]. Jonathan apples in 1943 showed 85 per cent. of the fruit attacked by *Venturia inaequalis* in the controls, 12 per cent. on trees sprayed with cosan at 1:1,000, 11·5 per cent. at 1:500, and 5·5 per cent. on those treated with home-made colloidal sulphur.

Săvulescu (T.). **Rumania. Agricultural parasiticides authorized for use in the country.**—*Int. Bull. Pl. Prot.*, xv, 3, pp. 41 m–49 m; 4, pp. 67 m–73 m, 1941. [Received July, 1946.]

The fungicides and insecticides authorized for use by the Rumanian Ministry of Agriculture are tabulated and grouped according to the type of compound, the name of the product, the supplier, the disease or pest controlled, and the dose recommended being given for each. The manufacture, sale, and use of fungicides, insecticides, etc., are permitted in Rumania only if they conform to provisions laid down in Royal Decree No. 361 of 19th March, 1937, published in the *Monitorul Oficial*, i, 67, 22nd March, 1937.

Davies (W. H.) & Sexton (W. A.). **Chemical constitution and fungistatic action of organic sulphur compounds.**—*Bio-chem. J.*, xl, 3, pp. 331–334, 1946.

A series of xanthic, dithiocarbamic, thiocyanic, and isothiocyanic derivatives, together with some oxygen analogues and benzthiazole derivatives, were tested for their relative toxicity to *Fusarium graminearum* [*Gibberella zeae*], *Penicillium digitatum*, *Cladosporium herbarum*, *F. caeruleum*, and *Botrytis cinerea* (the last three were discontinued in the later stages of the experiments). The lower xanthates, notably potassium methylxanthate, and certain substituted arylisothiocyanates must be regarded, on the basis of these trials, as among the most highly fungistatic synthetic organic substances known, the activity of the latter group being at least equal to that of the best arylmercuri-salts, e.g., phenylmercuriacetate, though falling short of the more powerful ethylmercuri-salts. Potassium methylxanthate inhibited the growth of *B. cinerea* and *F. caeruleum* in dilutions up to 1 in 7,807,500. Phenyl thiocyanate was active up to 1 in 62,500, also against the relatively refractory *P. digitatum.*

The recruitment and training of plant pathologists in Great Britain. A report prepared by the Plant Pests and Diseases Committee and adopted by the Council of the Association of Applied Biologists.—*Ann. appl. Biol.*, xxxiii, 1, pp. 119–123, 1946.

The Committee's recommendations [cf. *R.A.M.*, xxiv, p. 460] are, *inter alia*, for the provision of one or more plant pathology training centres directed by plant

pathologists using satisfactory laboratory and field facilities; higher standards of training in plant pathology should be required for County Officers and refresher courses provided; specialist advisers and research workers should have a degree in pure science and then attend a training centre for two years for instruction in plant pathology, husbandry, and cognate subjects and to obtain experience in research, adequate financial aid being given for this training and for maintenance of the student.

WHIFFEN (A[LMA] J.). **Aerosol OT in the preparation of microscopic mounts of fungi.**—*Mycologia*, xxxviii, 3, p. 346, 1946.

The use of one per cent. aqueous solution of aerosol OT [*R.A.M.*, xxii, p. 171] is recommended as a wetting agent for temporary mounts of fungi, having been employed successfully in mounting *Aspergilli, Penicillia,* Mucorales, Actinomycetes, and miscellaneous Hyphomycetes. This solution mixes easily with lactophenol.

KURTH (E. F.) & CHELDELIN (V. H.). **Feeding yeasts from wood sugar stillage.**—*Industr. Engng Chem.*, xxxviii, 6, pp. 617–619, 1946.

In a comparative study at the Oregon Forest Products Laboratory on *Torulopsis utilis, Mycotorula lipolytica,* and *Hansenula suaveolens,* all three yeasts gave a satisfactory performance on still waste liquors from Douglas fir [*Pseudotsuga taxifolia*] hydrolysates, little difference being observed between their growth rates, sugar utilization, yeast yield, and nutritional value [*R.A.M.*, xxv, p. 270]. When dried, the yeasts may be expected to furnish a fodder serving as an excellent source of protein, amino acids, and B vitamins, comparing favourably in this respect with the best strains of brewer's yeast [*Saccharomyces cerevisiae*]. Dry yeast yields ranging from 53 to 63 per cent. of the weight of the sugar consumed have been obtained.

Verordnungen der Regierung im Protektorate der Jahre 1941–1942 betreffs des Kartoffelkrebses (Synchytrium endobioticum). [Government Orders in the Protectorate during the years 1941–1942 relating to Potato wart (*Synchytrium endobioticum*).]—*Ochr. Rost.*, xviii, pp. 159–160, 165–166, 181–186, 1942, issued 1943. [Abs. in *Neuheiten PflSch.*, xxxvii, 3, p. 86, 1944. Received March, 1946.]

Each time potatoes are transported from a zone infested by wart disease (*Synchytrium endobioticum*) to other parts of Czechoslovakia [*R.A.M.*, xvii, pp. 500, 501, 550], the railway waggon must be disinfected with a 10 per cent. solution of formalin on completion of the journey. As from 1st March, 1945, immune varieties only are to be cultivated. Up to November, 1942, 92 communities in 13 districts had been proclaimed infested and a number of others suspected of harbouring the fungus. For a period provisionally fixed at ten years, tubers of immune varieties only may be consigned from the infested zones to certain specified areas, the cultivation therein of all other Solanaceae being prohibited and the eradication of solanaceous weeds obligatory.

HENNING (L. J.). **Departmental inspection and certification of seed Potatoes.**—*Fmg S. Afr.*, xxi, pp. 313–319, 1946.

The regulations with which potato-growers wishing to cultivate seed potatoes in apparently suitable areas under a certificate of the South African Department of Agriculture are required to comply are fully set out and cover, *inter alia,* standards for 'A' and 'B' certificates and field and tuber inspection, seed sizes, sale of seed potatoes, crop inspection for fungal, bacterial, and virus diseases, and the determination of virus diseases.

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Gottlieb (D.). **A physiological and biochemical basis for research on fungicides.**—*Bull. Torrey bot. Cl.*, lxxiii, 4, pp. 339–345, 1946.

The author draws attention to the importance of studying the fundamental structure and metabolic processes of fungi as being necessary for the solution of several problems conditioning the successful synthesis of fungicides. Hitherto, in the absence of such information, research for the development of more effective fungicides has been conducted largely by empirical methods.

He suggests that Horsfall and Zentmyer have offered a rational approach to such studies (abs. in *Phytopathology*, xxxiv, p. 1004, 1944) by determining several generic compounds normally found in all cells, and then testing the toxicity to fungus spores of various reagents employed for their analysis. These reagents were found to possess good fungistatic properties. In order to make practical use of this knowledge, it is necessary to study not only the characteristics common to all living cells, but also their specific modifications and biological transformations within the fungus.

Physiological differences between host and pathogen condition the synthesis of the ideal fungicide, which should be able to attack the spore in the early stage of germination. Marsh [*R.A.M.*, xx, p. 414] found that some spores depend for germination on external sources of carbon, such as dextrose or alcohol. An effective fungicide should be capable of withholding such nutritive materials.

Cytological investigations are required in order to determine the composition of cell walls and cell membranes and their permeability, so that means may be found to assist the passage of fungicidal molecules through the cell membranes and their arrival at the seat of specific protoplasmic activity. For this purpose, the data provided by such studies should assist the synthesis of organic chemicals by means of which a proper balance can be adjusted between hydrophilic and hydrophobic groups.

The value of a knowledge of the mineral nutrition of fungi in research for the control of plant diseases was shown by Zentmyer, who inhibited the growth of *Fusarium oxysporum* f. [*bulbigenum* var.] *lycopersici* by adding 8-quinolinol to the medium and found that, while zinc is required for the development of the fungus, it is precipitated by the reagent, with the result that the fungus is deprived of an essential nutritional element (*Science*, N.S., c, pp. 294–295, 1944).

Information is also scanty on the vitamin requirements of fungi and their role in the respiratory and metabolic mechanisms. The structure of a vitamin can be altered so that analogues are produced, the effect of which is sometimes to convert the material into an anti-vitamin inhibiting the growth-promoting activity of the original compound. Unpublished studies by the author are mentioned in which the absence of vitamin C in some fungi is recorded, although it occurs in most plants; and he asks whether the opposite might not occur and a vitamin be found which is essential to and manufactured by the fungus, but not essential to the

host. If an inhibitor of such a vitamin could be found, its injection into the host might inhibit the growth of the fungus without altering the metabolism of the plant.

Other lines of research advocated include studies of the respiratory enzymes and of the toxic specificity of the toxins which inhibit them. The paper concludes with references, *inter alia*, to the possibilities for fungicide development opened up by such work as that of Brian and McGowan [*R.A.M.*, xxiv, p. 427], in the isolation of a new antibiotic from *Trichoderma viride*, and of Geiger and Conn (*J. Amer. chem. Soc.*, lxvii, pp. 112–116, 1945), who considered that the inactivation by cysteine of antibiotics such as clavacin and penicillic acid suggested that synthetic chemicals of similar structure should make good fungicides; and to studies of the electric charge on spores, and of the specificity of fungicides.

Ciferri (R.). **Le grandi endemie come causa di traslazione dei maggiori centri di culture agrarie coloniali.** [The great endemics as a cause of the transfer of the larger centres of colonial agrarian crops.]—*Scientia*, xxxv, pp. 103–112, 1941. [Received February, 1946.]

The author puts forward the view that one of the reasons for the removal of the cultivation of important colonial crops from their original habitats to other parts of the world has been the presence of endemic diseases at the original sites. This thesis is illustrated by well-known examples of crop movements in sugar-cane, *Hevea* rubber, cacao, and coffee due to the disease factor.

Cooke (T. F.) & Vicklund (R. E.). **Tropical testing chamber.**—*Industr. Engng Chem.*, Analyt. Ed., xviii, 1, pp. 59–60, 4 figs., 1 diag., 1946.

The tropical testing chamber of the Engineer Board was established at Fort Belvoir, Virginia, in the latter part of 1944 for the testing of resistance to tropical deterioration of many items of equipment, including cork, fabrics [*R.A.M.*, xxv, p. 410], leather [ibid., xxv, p. 409], rubber, wood and its products (such as paper), and materials used in the construction of electrical and electronic apparatus [ibid., xxiv, p. 379]. The chamber measures 14 ft. in width, 32 ft. in length, and 12 ft. in height, and is furnished with three layers of wall, the outer of brick, 9 in. thick, the middle of asphalt-impregnated mineral wool, 4·5 in., and the inner of transite, 0·375 in. The outer layer of the ceiling is an asphalt slag roof, next comes a layer of celotex, 1·5 in. thick, then a metal deck, a layer of asphalt-impregnated mineral wool 6 in., below it a 2-ft. air space, and finally a transite ceiling 0·375 in. The humidity and temperature within the room are controlled by heating and cooling coils, and a fan produces an air movement with a velocity of 4 to 5 miles an hour. For 18 hours a day the relative humidity is maintained at 90 ± 2 per cent. and the temperature held at $85° \pm 1°$ F., and for six hours the corresponding values are 95 ± 2 per cent. and $75° \pm 1°$. The condensation produced by this regular cycle provides a film of water ideal for fungus growth. The materials were inoculated with spore suspensions of 24 fungi, chiefly from the Pacific area.

Scheffer (T. C.) & Duncan (Catherine G.). **Fungistatic vapors for control of mold in packages and equipment.**—*Industr. Engng Chem.*, xxxviii, 6, pp. 619–621, 1946.

Tests are reported on the efficacy of the vapour phases of 47 chemicals in combating the moulding of sweet gum [*Liquidambar styraciflua*] sap wood, leather, malt agar, and pressure tape in closed containers by *Aspergillus*, *Penicillium*, *Stachybotrys*, *Stysanus*, *Chaetomium*, *Metarrhizium*, and *Memnoniella* spp. The work was carried out during the war in response to a request for advice as to the fungistatic treatment of certain military supplies and equipment [cf. preceding abstract] on which the use of preservative solutions would have been impracticable.

Some of the most promising compounds were benzaldehyde, 2-chloropyridine, ethyl mercuric chloride, and *ortho*-chlorophenol.

ZUCK (R. K.) & DIEHL (W. W.). **On fungal damage to sun-exposed Cotton duck.**—*Amer. J. Bot.*, xxxiii, 5, pp. 374–382, 2 pl., 1 graph, 1946.

Macroscopic and microscopic examination by the aid of reflected and transmitted light, mechanical tests, and reinoculation experiments have permitted the activities of the angiocarpous fungi, *Diplodiella cowdellii, Hendersonia sarmentorum, H.* sp., *Leptosphaeria* sp., *Diplodia* sp., *Phoma herbarum,* and *Ophiobolus* sp., as important decomposing agents of grey duck in particular, and cellulose in general, to be studied [cf. preceding abstracts]. The fungi grow usually only on the shaded surface of fabrics exposed in Florida and Louisiana at an angle of 45° facing south and only after long periods of exposure. Growths of *Alternaria* sp. and other Hyphomycetes precede the attacks by the angiocarpous fungi but apparently without weakening the fabric. A quantitative method is offered for assessing fungal, as distinct from non-biological, injury, and as a possible means of testing localized differential resistance to puncture and bursting which cannot be done by the techniques commonly used hitherto. The sodium hydroxide-carbon disulphide swelling test disclosed the beaded pattern on fibres from the clear areas but not from the dark fungus-infested areas of fabric exposed from 3 to 18 months. The results show that the fungus-infected areas become progressively weakened, but some areas of fabrics may remain undamaged even after 18 months' exposure. Grey duck, however, which consists of natural fibres with adhering fragments of seed coats, spun and woven, possesses a far higher liability to mildew than the fibres alone; bleaching and scouring should reduce this. Grey duck exposed at Baltimore for $2\frac{3}{4}$ years and mineral khaki exposed in Florida for 6 and 12 months showed some fungal attack but rarely any fructifications, while the fabric was equally weak in the attacked and in the clear areas.

COOK (R. P.) & BROWN (MARGARET B.). **Penicillin production on fractions from the Pea (Pisum sativum).**—Abs. in *Bio-chem. J.*, xl, 3, p. xxxiv, 1946.

By means of ethanol (80 per cent. v/v) precipitation fractions may be made from aqueous extracts of ground dried peas or the juice from green peas in pod which stimulate the growth of *Penicillium notatum* 1249 B21 [*R.A.M.*, xxv, p. 408] in surface culture on a basal medium described by R. P. Cook *et al.* in *Bio-chem. J.*, xxxix, p. 314, 1945. The penicillin yield is proportional to the dry-matter concentration of the fraction, reaching a maximum yield of at least 200 units per ml. at a value of 2 gm. per 100 ml. medium. The ethanol-precipitable fraction contains nitrogenous compounds and complex polysaccharides.

The salts of the basal medium play an important part in penicillin production, the addition of sodium chloride or crystallized magnesium sulphate enhancing yield and that of sodium nitrate or potassium phosphate depressing or inhibiting it, without affecting the growth of the mould. The substitution of glucose for lactose also inhibits penicillin production.

FOSTER (J. W.), WOODRUFF (H. B.), PERLMAN (D.), MCDANIEL (L. E.), WILKER (B. L.), & HENDLIN (D.). **Microbiological aspects of penicillin. IX. Cottonseed meal as a substitute for Corn steep liquor in penicillin production.**—*J. Bact.*, li, 6, pp. 695–698, 1946.

Cottonseed meal was found to be at least as good as maize steep liquor for penicillin production by the Demerec X1612 and Wisconsin Q strains of *Penicillium chrysogenum* [*R.A.M.*, xxv, p. 352]. In fact, in the absence of chemical precursors of the stimulating phenylacetyl-derivative type [ibid., xxv, p. 130], cottonseed meal is considerably superior to maize steep liquor for the object in view.

P. chrysogenum required an adaptation to lactose for the most rapid and efficient utilization of this carbohydrate in laboratory fermenters.

Rao (R. R.), Rao (S. S.), & Venkataraman (P. R.). **Utilization of Groundnut-cake hydrolysate as medium for production of streptomycin.**—*Nature, Lond.*, clviii, 4,001, pp. 23–24, 1946.

The inoculation with a spore suspension of *A[ctinomyces] griseus* of enzyme digest of groundnut-cake enabled antibiotic activity against *B[acillus] subtilis* to be determined within 48 hours of inoculation, and maximum activity was reached between the fifth and sixth day. Using the Schatz-Waksman media [*R.A.M.*, xxiv, p. 426], however, the presence of streptomycin was detected only between the fourth and fifth, and maximum activity occurred between the eighth and ninth, days.

Waksman (S. A.), Geiger (W. B.), & Reynolds (D. M.). **Strain specificity and production of antibiotic substances. VII. Production of actinomycin by different Actinomycetes.**—*Proc. nat. Acad. Sci., Wash.*, xxxii, 5, pp. 117–120, 1946.

In the course of the authors' experiments [*R.A.M.*, xxv, p. 308] the variation of antibiotic production according to the isolations used was demonstrated by one organism yielding some 10 times more, and another less, actinomycin than the original *Streptomyces antibioticus* although the less productive extract was purer. The antibiotic spectrum of actinomycin B, the second fraction associated with actinomycin, was similar to the latter, but variable for different isolations as regards its nature and activity. The negligible yields of the B fraction and the possibility that its activity derives from traces of actinomycin A present as impurities have led to the substitution of 'actinomycin' for actinomycin A and the discarding of the name 'actinomycin B'.

Marchionatto (J. B.). **Argentine Republic. Wilting of the terminal bud in Potato.**—*Int. Bull. Pl. Prot.*, xv, 9, pp. 161 M–162 M, 1941. [Received July, 1946.]

During 1937–8 and 1938–9, potato crops, especially of the Green Mountain variety, suffered severe damage in the Argentine as a result of attack by a new disease termed locally 'marchitez del brote terminal' (terminal bud wilt) and subsequently ascertained by A. M. Offermann and E. R. Vitoria to be due to *Solanum* virus 1 [potato virus X: *R.A.M.*, xx, p. 548]. The chief symptoms were etiolation of the bud tip, ring-shaped markings on the leaves, and necrosis of the buds, aerial stalks, and tubers. Severely attacked tubers caused only limited spread.

Minkiewicz (S.). **Poland. Chief diseases and pests observed in 1940.**—*Int. Bull. Pl. Prot.*, xv, 1, pp. 4 M–6 M, 1941. [Received July, 1946.]

Among the items recorded in this paper it is stated that new foci of wart disease (*Synchytrium endobioticum*) [*R.A.M.*, xvi, p. 832] were found in 1940 in the districts of Cracow and Warsaw.

Blattný (C.). **Vorläufige Mitteilung über die Rassen des Kartoffelkrebses Synchytrium endobioticum (Schilb.) Perc.** [Preliminary note on the races of the Potato wart *Synchytrium endobioticum* (Schilb.) Perc.]—*Ann. Acad. tchéchosl. Agric.*, xvii, 1, pp. 40–46, 1942. (Czech, with German summary.) [Abs. in *Neuheiten PflSch.*, xxxv, 3–4, pp. 83–84, 1942. Received March, 1946.]

The following physiologic races of potato wart (*Synchytrium endobioticum*) [*R.A.M.*, xxiii, p. 405] were differentiated by the study of a copious supply of Central European material: (*a*) mountain race group SB, comprising collections from southern Bohemia, the Bohemian Forest (Czechoslovakia), possibly Vorarlberg, eastern Moravia, the mountains of the former Carpathian Russia, and the

border zone between northern Moravia and north-eastern Bohemia; (*b*) east German lowlands race-group, converging with NB in Schluckenau and northern Bohemia, and (*c*) west German race-group, possibly identical with (*a*). The existence of physiologic races of the pathogen explains why certain potato varieties, e.g., Curba and Roode Star, are susceptible in some countries and immune in others, and further accounts for the variable symptoms of the disease on the aerial organs (normal excrescences, quite insignificant galls, or mere subinfections) according to the place of origin of the host and fungus.

The practical applications of the discovery of racial specialization in *S. endobioticum* include field tests in the several areas harbouring different races; specification of morphological dissimilarities, if any, as an aid to diagnosis; revision of the resistance of individual varieties by tests with the various races; and stringent supervision of the export of tubers from the infested areas of each of the above-mentioned geographical zones.

Résultats des expériences faites avec diverses variétés de Pommes de terre à Câmpia Turzii, 1937–42. [Results of tests with potato varieties at Câmpia Turzii, 1937–42.]—*Anal. Inst. Cerc. agron. Român.*, xv, pp. 169–170, 1945.

In a comparative survey of potato varieties long cultivated in Rumania and of those imported from Germany during 1940 and 1941 in order to provide varieties resistant to black scab [wart disease: *Synchytrium endobioticum*: see preceding abstract], to which native varieties are susceptible, Goldball showed the highest yield over the period 1937 to 1941, but owing to its susceptibility to wart disease has had to be replaced by the German varieties, Frühbote and Frühmölle.

Foëx (É.). **La lutte contre le mildiou Phytophthora infestans (Mont.) de Bary de la Pomme de terre.** [The control of Potato blight, *Phytophthora infestans* (Mont.) de Bary.]—*C.R. Acad. Agric. Fr.*, xxvii, 4, pp. 219–229, 1941. [Received August, 1946.]

This is a brief critical discussion in popular terms of the control measures generally adopted in most countries against potato blight (*Phytophthora infestans*), reference being made to resistant varieties, fungicidal treatments, spray warnings, and the destruction of the haulms of seed potatoes by sulphuric acid. During 1938, Dufrénoy in the Hautes-Pyrénées and Limasset at Versailles both confirmed the validity of Beaumont's two conditions for infection, i.e., minimum temperature not lower than 10° C. and relative humidity not under 75 per cent. for two consecutive days [*R.A.M.*, xvi, p. 514.]

Crépin (C.) & Bustarret (J.). **Quelques problèmes de l'amélioration de la Pomme de terre.** [Some problems related to the improvement of the Potato.]—*C.R. Acad. Agric. Fr.*, xxvii, 18, pp. 1014–1024, 1941. [Received August, 1946.]

The authors record a very severe outbreak of late blight [*Phytophthora infestans*] of potato in France in 1941, following an earlier heavy infection by *Rhizoctonia* [*Corticium solani*]. Destructive attacks of blight of this kind are attributed to the increased planting of the susceptible Bintje (or Dikke Muizen) variety, which had largely replaced Industrie (Ronde Jaune) over much of the northern part of France.

Pending the establishment of sufficient spray-warning stations to render spraying effective, the use of resistant late varieties is urged. Ackersegen and Cellini, semi-late varieties of mediocre quality, show good resistance, and the authors consider, as the result of their work, that this quality could be bred into new resistant strains. Such new varieties should also be resistant to wart [*Sychytrium endobioticum*].

In tests, the progeny of Cellini crossed with a German hybrid between potato and *Solanum demissum*, were nearly all more resistant than Cellini itself.

Large (E. C.), Beer (W. J.), & Patterson (J. B. E.). **Field trials of copper fungicides for the control of Potato blight. II. Spray retention.**—*Ann. appl. Biol.*, xxxiii, 1, pp. 54–63, 1 fig., 1 graph, 1946.

The authors' second study of this subject [*R.A.M.*, xxv, p. 314] gives the results of experiments made during four seasons at Dartington, south Devon, to determine the spray-retention capacity of copper fungicides, including Bordeaux mixture, cuprous oxide, copper oxychloride, and finely divided metallic copper, for the control of *Phytophthora infestans*. Maincrop potatoes were twice sprayed, first with about 120 gals. and second with 160 gals. to the acre. After three to four weeks, with $2\frac{1}{2}$ to $3\frac{1}{2}$ in. rain, 1 per cent. Bordeaux mixture showed 40 per cent. spray retention, that of cuprous oxide and copper oxychloride at the same copper dosage with water-soluble dispersing agents was less than 20 per cent.; adhesion was sometimes improved by the addition of bentonite as an insoluble sticker. More frequent spraying with 0·5 per cent. Bordeaux mixture and other low-copper fungicides assured adequate deposits. A quick method for estimating total foliage expansion is described and its importance for estimating spray retention, together with that of spray timing near the time of maximum expansion, is emphasized. Sprayed potato leaves were experimentally shown to have a copper content of about 0·02 mg. copper per 120 sq. cm. over that of unsprayed leaves.

The disk method of estimating spray retention, using four to six independent samples per treatment, was found reliable within ± 10 per cent. By using an alternative battery-washing, whole-leaf method [which is described], an increased copper deposit of 30 per cent. over that detected by the disk method was recorded, attributable to the denser copper deposits (already shown in a preliminary experiment) in the leaf tips; these were not included in the disk samples.

The general conclusion from all experiments undertaken was that effective protection against blight under relatively severe incidence can be assured by maintaining a coverage of not less than 0·5 mg. copper per 120 sq. cm. over the whole expanse of the foliage; and that any of the fungicides tested afford equally good control provided that sufficient applications are made, according to the copper dosage or the adhesive properties of the compounded spray material or both, so that the requisite concentration of copper is maintained on the leaves.

Thomas (J. D.). **Two aids for the study of Potato-late-blight epidemiology.**—*Phytopathology*, xxxvi, 4, pp. 322–324, 1 graph, 1946.

An accurate measure of viable inoculum and an assessment of the environmental factors influencing infection and pathogenesis are essential to the study of plant-disease epidemics. In 1943 the writer exposed at the Minnesota Agricultural Experiment Station potted potato plants that had been raised in a greenhouse under conditions precluding accidental contamination by late blight (*Phytophthora infestans*). At the end of the exposure periods (either overnight or for four hours during the day) the plants were transferred to the laboratory and incubated at 70° F. and 100 per cent. relative humidity. Late-blight lesions usually began to appear three to four days after the exposure of the plants; they were counted and their numbers, together with those of the sporangia trapped on vaselined slides simultaneously exposed, were used to determine the 'blight-infection' potential. None of the control plants, taken direct from the greenhouse and incubated under identical conditions with the foregoing, contracted the disease.

An estimate of the viable inoculum at a given place being available, predictions regarding blight development will depend on an exact knowledge of the environmental factors affecting spore germination and infection [*R.A.M.*, iii, p. 173; xxiv, p. 468, *et passim*]. To compare the meteorological conditions in the atmosphere with those among the plant foliage, or 'foliarsphere', temperature and humidity were measured among the leaves of potato plants in the field and also at a point

5 ft. above the rows. The relative humidity was measured by means of dew-point apparatus. The temperatures in the two locations were found to differ only slightly, but there were frequently striking disparities in relative humidity, notably on 8th, 12th, and 14th July, on which dates the values (at mid-day) in the 'foliarsphere' and atmosphere were approximately 80 and 55, 100 and 70, and 90 and 70 per cent., respectively. On 2nd and 12th July 0·3 in. rain fell. Late blight was observed in the field on the 7th and increased from then until the 19th. Judged by conventional meteorological criteria, the weather during this period was not conducive to blight development, but the higher relative humidities in the 'foliarsphere' probably provided favourable moisture conditions over a sufficient period to permit fructification of the fungus and germination of the inoculum.

FOURMONT (M. R.). **Technique rapide pour les essais d'efficacité de produits chimiques contre le mildiou de la Pomme de Terre.** [A rapid method for testing the efficacy of chemical products against Potato blight.]—Reprinted from *C.R. Acad. Agric. France*, ccxxi, 30th May, 1945, 3 pp., 1945.

Bintje potato plants in pots were given three treatments of various chemicals against *Phytophthora infestans*, placed next day in a cellar at 12° to 14° C., sprayed with a suspension of the fungus, covered with a cloche, and left for 24 or 48 hours. The cloches were then removed and the plants returned to the greenhouse, the first lesions appearing six to seven days after inoculation.

On the twelfth day following the chemical treatments two untreated controls showed, respectively, 11 and 12 lesions, two plants treated with 1 per cent. Bordeaux mixture (250 gm. copper per hectol.) and two with copper acetate containing 11 per cent. copper and used at 2 per cent. (220 gm. copper per hectol.) showed no lesions, while those treated with a cupro-arsenical material containing 10 per cent. copper and used at 2 per cent. (200 gm. copper per hectol.) had 3 and 1; with an organo-cupric complex containing 18 per cent. copper, and used at 1 per cent. (180 gm. copper per hectol.) 2 and 0; with an organic D (no copper) 7 and 9; and the one plant tested with an organic product E (no copper) 13 lesions.

It is claimed that this method enables the value of different fungicides to be estimated in 12 days. A field test of the more satisfactory materials should follow.

WHITE (N. H.). **Host parasite relations in pink rot of Potato.**—*J. Aust. Inst. agric. Sci.*, xi, 4, pp. 195–197, 1946.

Investigations carried out in the Plant Pathology Laboratory, Department of Agriculture, Tasmania, showed that in an inoculated potato tuber partly invaded by *Phytophthora erythroseptica* three distinct zones are observed, one of living, uninvaded tissue, a second of invaded, but living tissue, in which the fungus behaves as a true parasite, and a third of invaded but dead tissue which gives a characteristic pink coloration when exposed to oxygen. In this dead tissue the fungus lives on saprophytically. An oxidizing reaction by tyrosinase due to the mixing of cell metabolites in the presence of oxygen after death is responsible for the colour changes in the dead zone. Following the invasion of the tissue by *P. erythroseptica*, the intercellular mycelium causes the host cells to become increasingly permeable and the phosphorylated compounds to be decomposed. This leads to decompensated respiration and to the death of the tissue. It is not known how the permeability of the cells is altered by the fungus.

NATTRASS (R. M.). **Note on the bacterial wilt disease of the Potato in Kenya.**—*E. Afr. agric. J.*, xii, 1, p. 30, 3 figs., 1946.

The author reviews the symptoms of the disease previously described by him [*R.A.M.*, xxiv, p. 200] and then thought to resemble *Corynebacterium sepedonicum*, on the basis of the putty-like, rather than slimy consistency of the bacterial

exudant and lack of discoloration of the vascular tissue in either stem or tuber. Cultures of the pathogen have been identified by W. J. Dowson as an atypical strain of *Xanthomonas solanacearum*, which thus differs in its effects on the host from all other described strains in not staining the vascular tissue in either potatoes or tomato. Some differences in cultural characters are also reported by Dowson.

Inoculation tests with this organism in Kenya, and general observations show it to be highly virulent on potato and tomato, but not on tobacco. It thus resembles Wager's South African strain [ibid., xxiv, p. 49]. Inoculations of tobacco leaf midribs, while producing no systemic infection, caused a slow necrosis of the tissue, from which the bacteria were recovered 78 days later.

BALDACCI (E.). **Sterility of Rice panicles.**—*Int. Bull. Pl. Prot.*, xv, 6, pp. 114 M–116 M, 1941. [Received July, 1946.]

Rice panicle sterility, while it has often been associated in Italy with 'brusone' or blast (*Piricularia oryzae*) [cf. *R.A.M.*, xvii, p. 61], is now considered to be mainly of physiological origin, and related to certain soil factors as yet undetermined.

CUNNINGHAM (I. J.). **Bluestone topdressing pays on copper-deficient peat land.**—*N.Z. J. Agric.*, lxxii, 3, p. 261, 1946.

Copper sulphate top dressings are recommended as a corrective for copper deficiency common on the peat soils of New Zealand, the cost per farm averaging £10 for the copper sulphate plus the cost of labour for applying it, which should be done in autumn in conjunction with the normal top dressings. The immediate object of the treatment in the present paper was the control of the 'peat scours' copper deficiency disease in dairy cattle and the raising of the average butterfat production.

LEHR (J. J.). **Over de betekenis van borium voor de landbouw.** [On the importance of boron in agriculture.]—*Meded. bot. Lab. (Mus.) Rijksuniv. Utrecht* 2, 193 pp., 7 graphs, 1 map, 1940. [English summary. Received July, 1946.]

This is a fully tabulated survey and discussion of the author's observations and experiments in Holland on boron deficiency of the soil, especially in relation to two well-known diseases associated with a shortage of the mineral, viz., beet heart rot and turnip brown heart. Outstanding contributions to the relevant literature are reviewed and a three-page bibliography is appended.

SĂVULESCU (ALICE). **O nouă boală pe Carthamus tinctorius L. (şofranaş), produsă de ciuperca Macrosporium carthami Săvul.** [A new disease of *Carthamus tinctorius* L. (Safflower), caused by the fungus *Macrosporium carthami* Săvul.]—*Anal. Inst. Cerc. agron. Român.*, xv, pp. 213–214, 1945.

This new disease of safflower caused by the fungus *Macrosporium carthami* [*R.A.M.*, xix, p. 116] was first noticed in 1940. Spots appeared on both sides of the leaf surface and, in cases of serious infection, on the branches and stem; flowering is considerably or entirely arrested, and great damage is done. The fungus forms a dark mycelium on the plant and conidiophores on the leaf surface. Conidia and a resistant mycelium were found on the seed coat.

The optimum temperature for the germination of the spores is 23° C. and germination took place up to 29°. The spores tolerate a temperature of 0° and death occurs after holding them for 20 hours at 40°. A rather low humidity is sufficient for germination, and they resist dry atmospheres well. The fungus was grown in culture on Czapek, malt agar, and maize meal agar. There was, however, no spore formation, but a resistant mycelium appeared in about three days, the most favourable pH being 6·6.

A temperature of about 25° is required for the development of infection in the field, and humidity for its expansion. When temperatures rise or dry weather continues, the disease does not make much progress. Infection is produced by spores from the soil, fallen leaf-refuse, by wind-borne spores and by resistant mycelium on the seed.

Of seven varieties of safflower cultivated in Rumania, the local, Giessen, and Krasnodar varieties are resistant, and the Bessarabian, Yenica [? Yenidje], Anatolian, and Pavlikeni susceptible. Experiments undertaken with this fungus indicate that it is restricted to a single host. Safflower is attacked either before or during flowering and only in favourable conditions of temperature and humidity.

The cultivation of resistant, high-yielding varieties such as the local and, secondly, Giessen, burning of infected plants and plant refuse, and abstention for some years from growing the crop on land where the disease has occurred, are measures recommended for control. Seed-disinfection with mercurials did not give control.

Mehta (P. R.), Singh (B.), & Bose (S. K.). **Some new hosts of Sclerotinia sclerotiorum (Lib.) De Bary.**—*Curr. Sci.*, xv, 6, pp. 171–172, 2 figs., 1946.

Butler and Bisby have recorded the hosts of *Sclerotinia sclerotiorum* in India [*R.A.M.*, xi, p. 545], and Mundkur has given a comprehensive account of the taxonomy of the fungus and its parasitism on *Hibiscus sabdariffa* [ibid., xiv, p. 106]; he was the first worker in India to induce apothecial formation in culture. In February, 1946, *Eruca sativa*, grown mainly as an oil-seed crop in the United Provinces, was severely attacked by *S. sclerotiorum*, which formed scattered, elongated, sometimes concentrically zonate lesions on the stems and finally encircled them. The diseased portions were overrun by a white, cottony mycelium, embedded in which were black sclerotia, 2 to 12 (average 6) mm. in diameter. The ground was littered with these organs, up to 78 per sq. ft. being counted in areas of intensive infection. In moist patches apothecia arose from sclerotia buried in the soil, this being apparently the first record of their natural occurrence in India. The stipe measures 25 to 88 mm. in length and is fawn-coloured where exposed, brown or dark brown within the soil. The mature apothecia are 6 to 9 mm. across, cartridge-buff to pale ochraceous-salmon, turning cinnamon- or Mars-brown (Ridgway) with senescence, and are generally borne 6 to 10 mm. above soil-level. The asci contained in these bodies measured 108 to 153 by 4·5 to 8·1 (average 122·9 by 5·9) μ, and the ascospores 7·2 to 11·7 by 3·6 to 5·4 (8·9 by 3·9) μ. The dimensions of the asci and ascospores differ from those given by Mundkur [loc. cit.], but agree with those of a culture supplied by the Imperial Agricultural Research Institute, New Delhi. No cultural differences were observed between the isolates of *S. sclerotiorum* from *E. sativa* and those from *Brassica juncea* and coriander, which were also infected in a very mild form.

Chowdhury (S.). **Control of Cercospora blight of Til.**—*Indian J. agric. Sci.*, xv, 3, pp. 140–142, 1945.

The sesame blight caused by *Cercospora sesami* is a serious disease in Assam [*R.A.M.*, xxiv, p. 219], where it causes an average annual yield reduction of 5 per cent. The pathogen is perpetuated by infected seeds and plant residues in the field. Chemical seed treatments were ineffectual against the disease, but half an hour's immersion in water heated to 128° F., as recommended by Nusbaum [ibid., xxi, p. 44], gave excellent results in large-scale field plantings in 1943 and 1944. After one year's storage the seeds were free from superficial contamination but the fungus still persisted in the interior.

RHIND (D.) & SETH (L. N.). **The fungi of Burma.**—*Indian J. agric. Sci.*, xv, 3, pp. 142–155, 1945.

This is a partial list, compiled mainly from various publications, of the fungi of Burma, the study of which has been seriously hampered by the loss, during the evacuation of the country in 1942, of most of the laboratory records and herbarium specimens, the latter numbering over 700.

MOESZ (G. v.). **Neue Pilze aus Lettland.** [New fungi from Latvia.]—*Bot. Közl.*, xxxviii, 1–2, pp. 68–73, 5 figs., 1941. (Hungarian.) [Abs. in *Neuheiten PflSch.*, xxxvi, 1, p. 4, 1943. Received March, 1946.]

Selenophoma calamagrostidis Moesz & Smarods causes spotting of living *Calamagrostis epigeios* leaves. *S. septorioides* Petr., the agent of *Astragalus* leaf spot, is distinct from *S. septorioides* R. Maire on *Arundo donax,* and the former species is accordingly renamed *S. petrakii* Moesz. *Ascochyta hieraciicola* M. & Sm. forms large lesions on cultivated *Hieracium villosum* leaves, while *Cylindrosporium arundinaceum* is responsible for a smaller foliar spot of *Calamagrostis arundinacea.*

BONAR (L.). **Studies on some California fungi. III.**—*Mycologia,* xxxviii, 3, pp. 339–345, 1946.

These studies of 16 Californian fungi, include the following items of interest. The range of *Coleroa chaetomium* (Kze) Rabh. var. *americana* Petrak (*Ann. mycol., Berl.* xx, p. 181, 1922), originally described from material collected in the State of Washington, is extended by the discovery of a somewhat severe infection of the leaves of *Rubus leucodermis* plants in Trinity county, north California, and may endanger the nearly related cultivated raspberries. The glabrous perithecia of this variety distinguishes it from the European species, *C. chaetomium.*

Guignardia camelliae is recorded on living tea leaves [*R.A.M.*, xxi, p. 166] in the Strybing Arboretum, Golden Gate Park, San Francisco, California. As the host plants were grown from seed and no other tea plants are known from the vicinity, the appearance of the fungus in this area is surprising.

Ascochyta salicis, n.sp., found on living leaves of *Salix laevigata* in Monterey county, California, is assigned to the genus *Ascochyta,* as the mature conidia in the extruded cirrhi are usually uniseptate, although a fraction of 1 per cent. of them may develop a second septum. The fungus produces scattered, angular spots, 2 to 10 mm. in diameter. The pycnidia are hypophyllous, with membranaceous, carbonaceous walls, and measure 80 to 145 μ in diameter. The conidia are fusiform, straight, or slightly curved, uni- or very rarely biseptate, and the conidiophores very short and blurred, up to 5 μ long.

WEHMEYER (L. E.). **Studies on some fungi from north-western Wyoming. II. Fungi Imperfecti.**—*Mycologia,* xxxviii, 3, pp. 306–330, 22 figs., 1946.

These studies of 35 Fungi Imperfecti found in north-western Wyoming include 20 new species, of which 13 are *Phoma,* and one new combination. One of the new species, *Hendersonia pinicola,* found on living needles of *Pinus murrayana,* is described as presenting small, irregular, black, paint-like agglomerations of conidia, discharged from globose pycnidia, 100 to 150 μ in diameter, entirely sunken in the leaf mesophyll and opening by a minute ostiole. The pycnidial wall consists merely of the subhymenial prosenchyma and a few immersed host cells. The conidiophores are short, 5 to 6 μ in diameter, and the conidia fusoid-ellipsoid to clavate, brown, unicellular at first, ultimately quadricellular, and not constricted at the septa, 14 to 20 by 5 to 7 μ.

Arwidsson (T.). **Einige parasitische Pilze aus Juan Fernandez und der Osterinsel.** [Some parasitic fungi from Juan Fernandez and Easter Island.]—*Svensk. bot Tidskr.*, xxxiv, 4, pp. 293–300, 1 fig., 1940. [Received July, 1946.]

Included in this critically annotated list of one Ascomycete, one smut, and ten rusts from the Skottsberg collections in Juan Fernandez and Easter Island is *Cerotelium fici* on fig [*R.A.M.*, xxiii, p. 316] in the latter locality.

Singer (R.) & Smith (A. H.). **Proposals concerning the nomenclature of the gill fungi including a list of proposed lectotypes and genera conservanda.**—*Mycologia*, xxxviii, 3, pp. 240–299, 1946.

Lectotypes of 198 genera of Agaricaceae are proposed for acceptance, validation, or rejection by International Congress. Eight desiderata are set out for the selection of lectotypes, the absence of which in many of the older genera has tended to make orderly taxonomy impossible.

Thom (C.) & Raper (K. B.). **Aspergillus or what?**—*Science*, N.S., ciii, 2686, p. 735, 1946.

The authors advocate the international recognition of *Aspergillus* for both ascosporic and conidial forms of the fungi belonging to this genus.

Karling (J. S.). **Brazilian Chytrids. VIII. Additional parasites of rotifers and nematodes.**—*Lloydia*, ix, 1, pp. 1–12, 53 figs., 1946.

Continuing his studies on Brazilian chytrids [*R.A.M.*, xxv, p. 423], the author describes two new species of *Olpidium*, *O. granulatum* and *O. rotiferum*, which were found parasitizing rotifer eggs and adults in Matto Grosso and Amazonas, and one of *Phlyctochytrium*, *P. nematodeae*, on nematode eggs and adults, the only known species of the latter genus attacking animals and apparently non-pathogenic to algae. Rotifer eggs and adults were also found to be infected by *Rhizophydium gibbosum*, *R. zoophthorum*, *Endochytrium operculatum*, and *Catenaria anguillulae* in the same States.

Kostov (D.) & Georgievna (Mme R.). **Устойчивость на мозаичния вирусъ. I. Устойчиви тютюни на мозаичния вирусъ, получени чрезъ кръстосване. II. Наследяване на некротичната реакция и селекционната стойность на формата Nicotiana tabacum var. virii.** [Resistance to Tobacco mosaic virus. I. Tobacco varieties resistant to mosaic virus experimentally produced. II. Inheritance of necrotic reaction and plant-breeding value of the strain *Nicotiana tabacum* var. *virii*.]—*Центр. Земед. Изслед. Контр. Инст., София*, [*Centr. agric. exp. contr. Inst., Sofia*], 56 pp., Sofia, 1944. [English translation. Received July, 1946.]

In continuation of his studies on tobacco mosaic [*R.A.M.*, xvii, p. 349] the first author states that for breeding resistant varieties reacting with local necrosis, the theoretical aspects of which were previously discussed, he tried two different hybrids, (1) (*Nicotiana rustica* RL, a variety reacting with local lesions only, × *N. tabacum*) × *N. digluta*, and (2) *N. tabacum* var. Basma × *N. digluta*. They were back-crossed either twice (1) or once (2) to *N. tabacum* var. Basma (used as female parent since it was found that the pollen from the hybrids gave more uniform results), then selfed, and the offspring selected in these and subsequent generations were those which reacted with local necrosis only, were most tobacco-like, and were fertile. From the F_6 generation from hybrid (1) a desirable variety homozygous for local necrosis, having 48 chromosomes and named *N. tabacum* var. *virii*, was selected for use in succeeding crosses.

The object of the second series of experiments done in collaboration with R. Georgievna was to transfer the necrotic reaction of *N. tabacum* var. *virii* to

the background of commercial varieties. Using the same selecting principles as before a cross between this new variety and No. 36 (Nevrocop Basma) gave in the F_3 generation three families homozygous for local necrosis, while another cross with the variety American White gave a single homozygous family in the F_2. Progeny of the hybrids between *N. tabacum* var. *virii* and the large-leaved varieties Virginia Brightleaf and Florida Black Shank Res. No. 301, while showing only local necrosis, had a large proportion of abortive pollen, and no results are given beyond the F_2.

The F_1 hybrid (*N. tabacum* var. *virii* × American White above) was used as one parent in a series of triple crosses with the following varieties, some of which are small-leaved like the parents and some large-leaved, Ustinsky No. 4, Trapezund, No. 36 Nevrocop Basma, Dubeck, Dzebelska Basma, Havana, Gold Dollar, Maryland Broadleaf, Virginia Brightleaf, One Sucker, *N. tabacum* var. *macrophylla*, and *N. syrii*. The F_1 hybrid (*N. tabacum* var. *virii* × No. 36 Nevrocop Basma) was similarly used with Varatik, Virginia, Faucett special, One Sucker, and *N. tabacum macrophylla*.

The progeny were selfed and gave rise to a large population of desirable forms all, or a large proportion, having the local necrotic character (some homozygous) which can be used for further experiments together with hybrids between *N. tabacum* var. *virii* and the tolerant American variety Ambalema [ibid., xxii, p. 308; xxiii, p. 499, *et passim*]. Such families, heterozygous, however, in respect of other morphological and physiological characters, may be used in different localities under varying environmental conditions for isolating desirable resistant varieties suitable to the different regions.

It was noted during the experiments that some plants reacted with 'flowing necrosis' at temperatures lower than 30° to 35° C. This, together with the fact that plants apparently similar genetically and inoculated under the same conditions at the same time, may react differently, suggests that the manifestation of flowing necrosis may depend on the genetic make-up as well as on temperature. If a gene-modifier is responsible for reaction at the lower temperature, then it is considered likely that a gene combination might be obtained which would raise the critical temperature so that the plant would react only at temperatures much higher than 30° to 35° C.

RAWLINS (T. E.), ROBERTS (CATHERINE), & UTECH (N. M.). **An electron microscope study of Tobacco mosaic virus at different stages of infection.**—*Amer. J. Bot.*, xxxiii, 5, pp. 356–363, 3 figs., 5 graphs, 1946.

In the course of electron-microscope studies preparations of purified tobacco mosaic virus from leaves infected for five days were found usually to contain more double-length particles than similar preparations from leaves infected for 20 days, thus confirming the results of Spencer's sedimentation researches [*R.A.M.*, xxi, p. 392]. Whether these particles result from a gradual lengthening of virus particles while present in the host or whether they represent a length-wise union of two characteristic particles some 300 mμ long has yet to be determined. Many particles in five-day virus exceeded 450 mμ in length, which may explain the findings of Stanley [ibid., xvii, p. 407] and Spencer [loc. cit.] who recorded fewer local lesions produced by a given weight of purified 7- and 5-day virus than by the same weight of 28- and 20-day virus.

The authors show that purification by alternate high and low speed centrifugation while the virus is suspended in dilute phosphate-hydrochloric acid solution, causes less tendency to lengthwise union of the particles than similar purification of virus suspended in distilled water.

The proportion of particles having an approximate length of 300 mμ is very high, their length being apparently controlled with great accuracy by certain factors

which have kept it within narrow limits without, however, producing particles of exactly the same length. While the evidence shows the presence of particles of this length in the host, it is unlikely that particles varying so little in length owe their formation to lengthwise aggregation of shorter particles. No union of particles was observed following the storage of purified virus for about one year in distilled water at 1° C.

BLENCOWE (J. W.) & CALDWELL (J.). **A new virus disease of Tomatoes.**—*Nature, Lond.*, clviii, 4003, pp. 96–97, 1946.

A virus disease of tomato plants grown out of doors [in Devon] under commercial conditions in 1944 is considered to be new. Marked symptoms of stunting, and the growth of axillary shoots of bushy appearance in the early stages, were observed. The growing point of the stem may be destroyed, which seems to stimulate proliferation, noticeably also on the main rachis at the bases of individual leaves, after normal 'stopping' and 'disbudding'. Fruits forming on the upper trusses after infection are almost invariably seedless and much smaller than normal fruits. This inhibition of seed formation is interesting from the point of view of the effect of virus diseases on megaspore and microspore formation.

The disease is sap-transmissible and quickly infects tobacco and *Nicotiana glutinosa* systemically, the symptoms in both cases appearing two or three weeks after inoculation. Tobacco shows a green-yellow mosaic with some ring-spotting and *N. glutinosa* necrosis and leaf distortion with a dark green blistering effect. No local lesions were seen on the inoculated leaves. Sap transmission of the disease into tomato occurred less readily than into tobacco and *N. glutinosa* and inoculation experiments with other Solanaceous plants failed. The virus persists in extracted sap for only one or two days at room temperature. Inactivation takes place after 10 minutes' exposure at 50° C. A neighbouring block of chrysanthemums was found to be the source of infection, but the symptoms on these plants were confined to mild stunting and leaf chlorosis.

Observations under experimental and commercial conditions recorded the rapid spread of the disease accompanied by serious loss. It is improbable that the pathogen is transmitted in the course of 'stopping' and 'tying-in' the plants. Further research on the disease is proceeding.

SCHUSSNIG (B.). **Eine neue Viruskrankheit der Tomatenpflanzen.** [A new virus disease of Tomato plants.]—*Forschungsdienst*, xvi, 2, pp. 62–84, 2 col. pl., 11 figs., 1943. [Abs. in *Neuheiten PflSch.*, xxxvii, 2, pp. 65–66, 1944. Received March, 1946.]

Tomatoes in south Moravia, Czechoslovakia, sustain heavy quantitative and qualitative damage from a virus disease first recognized by Baudys [*R.A.M.*, xiii, p. 355]. The symptoms include upward curving of the young leaf blades, which are rugose and show a yellow interveinal mottling, subsequently turning purple, downward bending of the petioles, squarrose appearance of the tips of the fruiting axes, stunting and necrosis of the foliage, and streak-like necroses on the petioles, pedicels, and stem axes, culminating in the dark brown discoloration, drooping, and death of the leaves. Typical of primarily infected flowers are virescence, abnormal elongation or arrested development of the sepals, more or less severe dwarfing of the petals, or even complete abortion of the buds. The fruits, however, set normally, the yield is not reduced, and only in severe cases do the seeds fail to germinate.

The symptoms on the fruits are the most distinctive and serve to differentiate the south Moravian tomato virus from any hitherto recognized. On the proximal portion of red-fruited varieties appears a pale ochre to lemon-yellow, green-spotted sector, the whole fruit later becoming mottled or remaining yellow without a tinge

of red. In the case of the yellow-fruited variety Bison the sector is brown. In all varieties the sector hardens though the flesh remains soft. The yellow discoloration is the outward expression of the underlying heavy accumulation of virus proteins through the dense network of the phloem system. The fruit septa and the placentae turn white, so that the affected products are unsuitable for canning, though the flavour is not impaired.

Intensive histological studies confirmed the virus origin of the disease, the fruits being the primary and recurrent focus of infection and the partial extension of the symptoms to the vegetative system a common but not essential sequel.

The virus was artificially transmitted by *Thrips tabaci* from diseased to healthy plants, as well as by means of a pruning knife wetted with inoculum.

The new tomato virus presents analogies with Milbrath's tip blight [a strain of the spotted wilt virus: ibid., xviii, p. 420], but is considered to be a separate entity and assigned the name of *Lycopersicum* virus 7.

RICHTER (H.). **Achtet auf die Dörrfleckenkrankheit der Tomaten !** [Beware of the Tomato dry spot disease!]—*Blumen- u. PflBau ver. Gartenwelt*, xlvii, 16, pp. 181–183, 4 figs., 1943. [Abs. in *Neuheiten PflSch.*, xxxvii, 2, pp. 50–51, 1944. Received March, 1946.]

An exceptionally severe outbreak on tomatoes of the early-blight phase of *Alternaria solani* is reported from several localities in Germany, the collar-rot symptoms described by American authors [*R.A.M.*, xxii, p. 116] being absent. As in the United States, the damage in the affected areas was computed at 50 per cent. of the crop. Control measures should include the burning of debris in the autumn, disinfection of the stakes, seed treatment, steam or formalin sterilization of the seed-bed, spraying with Bordeaux mixture (beginning on the seedlings), and immersion in the fungicide before transplanting.

SNYDER (W. C.), BAKER (K. F.), & HANSEN (H. N.). **Interpretation of resistance to Fusarium wilt in Tomato.**—*Science*, N.S., ciii, 2685, pp. 707–708, 1946.

Susceptible Bonny Best and largely resistant Pan-America tomato plants were grown in sterilized soil and infected at six weeks by incision of the tap-root under a suspension of *Fusarium oxysporum* f. *lycopersicum* [*F. bulbigenum* var. *lycopersici*]. The subsequent appearance of the fungus in the xylem and its almost equal growth in both varieties up through the root into the aerial stem suggested that there was little antibiotic influence present in the tracheal fluid of Pan-America plants [*R.A.M.*, xxiii, p. 194]. The number of vessels infected in Pan-America was considerably less than in Bonny Best and may explain the slow development of external symptoms in the former variety despite the presence of the fungus and it may be that, under the inoculation technique adopted, only those elements were infected into which the spores were actually drawn, while the multiple infection of the xylem elements in Bonny Best may be due to surface contamination of the lateral roots during inoculation and represent an example of mass fungal action in toxin formation.

Vigorous growth of the fungus *in vivo* in the diseased vascular elements of both varieties appears also to exclude a mobile inhibitor in one of them and the fact of such growth in the xylem of Pan-America suggests that its tolerance is not a property of the whole root system. A physiological explanation of Pan-America's resistance to *F. bulbigenum* var. *lycopersici* may reside in resistance to invasion, or to yellowing and wilting, or both, the first-named concerning the entry of the fungus into the xylem and the second toxin production in the tissue.

Assuming that invasion by the fungus takes place by way of the undifferentiated tissue behind the root-tip, the resistance of Pan-America may indicate a property, of the living cells only of the plant, which appears to prevent fungal penetration

of the lumina of the xylem tubes. It is concluded, therefore, that this resistance to *Fusarium* wilt is a direct function of the cellular protoplasm of Pan-America plants, as in the case of cabbage [ibid., xiv, p. 732].

DIACHUN (S.) & VALLEAU (W. D.). **Growth and overwintering of Xanthomonas vesicatoria in association with Wheat roots.**—*Phytopathology*, xxxvi, 4, pp. 277–280, 1946.

Tests were carried out at the Kentucky Agricultural Experiment Station to determine the capacity of *Xanthomonas vesicatoria* [*R.A.M.*, iii, p. 119 *et passim*], *X. phaseoli* var. *sojense*, and *Bacterium* [*Pseudomonas*] *medicaginis* var. *phaseolicola* to grow on wheat, tomato, bean [*Phaseolus vulgaris*], and soy-bean roots and to overwinter in association with wheat roots in a similar manner to *Bact.* [*Pseudomonas*] *tabacum* and *Bact. angulatum* [*P. angulata*: ibid., xxiii, 459, 476]. All three species multiplied and produced colonies on Thorne wheat, Rutgers tomato, Stringless green-pod bean, and Macoupin soy-bean roots, the first-named giving the most consistent results and apparently providing a more suitable substratum for *X. vesicatoria* and *X. phaseoli* var. *sojense* than their own hosts, tomato and soy-bean, respectively.

X. vesicatoria was the only one of the three organisms to be recovered from the roots of wheat sown out of doors in unsterilized soil in November, 1943, isolations being made from December to March, inclusive, but not in April. The tests were made by inoculating water-soaked tomato leaves with aqueous suspensions of macerated root fragments.

These observations would appear to confirm the general impression that the bean halo-blight organism cannot easily overwinter in the soil, if it does so at all, hence the feasibility of control through the use of disease-free seed. On the other hand, *X. vesicatoria*, like the tobacco leaf spots, is evidently perpetuated by other means, probably on the roots of neighbouring plants, and cannot be combated merely by sowing clean seed.

WAGER (V. A.). **Blossom-end rot of Tomatoes.**—*Fmg S. Afr.*, xxi, 5, pp. 309–312, 2 figs., 1946.

The use of a surface mulch on the soil of tomato plantations exposed to strong wind in hot, dry weather was found to promote more vigorous growth and to lower the incidence of blossom-end rot [*R.A.M.*, xxiv, p. 209]. The mulch, which can be made with grass, dead leaves, or lawn or hedge clippings, had the effect of lowering the soil tempeature from 113° F. (shade temperature 90°) at soil level to 81° 2 in. below the mulch and did much to redress the balance of water-supply to the plants, which is affected by excessive transpiration in the climatic conditions described. Watering of the plants, preferably by using a sprinkler system, with a view to avoiding alternations of dry and wet days, followed by cultivation, which has the additional advantage of keeping down weeds, also helps to conserve soil moisture. Liberal applications of humus, and of superphosphate where nitrogenous composts or kraal manure are used, and agricultural lime are additional protective measures recommended.

WHITEHEAD (S. B.). **Nutritional deficiencies in Tomatoes.**—*Gdnrs' Chron.*, Ser. 3, cxx, 3109, p. 43, 1946.

The symptoms of nitrogen, potassium, phosphorus, calcium, and magnesium deficiencies in tomatoes [*R.A.M.*, xxii, p. 332; xxiii, p. 461; xxiv, p. 389, and next abstract] are briefly described, the last-named being apparently on the increase in Great Britain. It may be corrected by the application of magnesium sulphate at a dosage of 1 oz. per gal. water per sq. yd. The other deficiencies are also remediable by soil amendments with an appropriate fertilizer, a useful and

well-balanced mixture consisting of two parts each of ammonium sulphate and potassium sulphate and three parts superphosphate, applied at the rate of one to two teaspoonfuls per plant every ten days.

HUNTER (J. G.). **Magnesium chlorosis of Tomatoes.**—*Nature, Lond.*, clviii, 4001, p. 25, 1946.

Heavy applications of magnesium sulphate to the soil as a method of controlling magnesium deficiency in tomatoes [*R.A.M.*, xxv, pp. 15, 291, and preceding abstract] have in the author's experience proved ineffective in south-western Scotland. Experiments at the West of Scotland Agricultural College showed that the absorption of magnesium declined with increasing concentration of the solution in which tomato plants were growing, and when the ratio of potassium to magnesium in it was high, chlorosis was most severe. The conductivity of the soil round chlorotic plants was high and usually higher than that of soil near by in which healthy or less affected plants were growing. Magnesium salts would thus prove harmful where the salt concentration was already dangerously high. Induced chlorosis was associated especially with the use of potassium sulphate as a fertilizer, although it was also caused by over-doses of other potassic fertilizers. The different absorption rates of potassium and sulphate ions may account for these harmful effects. Increasing the sulphate content of the medium at the same soluble salt concentration did not increase the chlorosis.

Early mulching with farmyard manure or peat by promoting secondary root production may help to alleviate the conditions in which induced magnesium deficiency occurs. Where it persists despite very low potash treatments, re-soiling may prove an effective and economic method of control. Repeated spraying with magnesium sulphate gave control but this method is not likely to be practicable in the West of Scotland.

SHANOR (L.). **A previously undescribed fungus causing a leaf spot of Bamboo.**—*Mycologia*, xxxviii, 3, pp. 331–338, 1 pl., 1 fig., 1946.

Infected leaves from the bamboo *Arthrostylidium racemiflorum*, received from El Salvador, on examination at the United States Bureau of Entomology and Plant Quarantine, were found to be harbouring a pycnidial fungus, and ascomata were observed to be developing on further material made available. The organism caused oval, linear, or fusiform spots, not more than 5 mm. long or 2 mm. wide, to appear on the leaves, the tissues becoming necrotic and eventually assuming a yellow-brown colour. The spots were usually scattered but occasionally coalesced. The pycnidial state appeared to precede the ascigerous and was usually the only phase observed on the diseased leaves.

The immersed pycnidial stromata are elongated and contain one to four cavities separated by parenchymatous walls. One conidium develops from each cylindrical conidiophore and abundant conidiophores line the stromatal cavities. Moistening of the mature stromata causes an irregular longitudinal rupture of the wall which facilitates the emergence of the spores. The hyaline, unicellular conidia, with two straight or slightly bent setae, which are attached slightly to the side, one near each end of the spore, are clavate to navicular: they measure up to 16·5 by 5·5 μ, and the setae 12 μ long. It is suggested that the fungus be included in the genus *Ciliochorella* Sydow & Mitter (*Ann. mycol., Berl.*, xxiii, pp. 46–71, 1935), with which it shares generic characteristics.

The perfect state of this fungus has always been found associated with pycnidial stromata, the ascomata, usually less than 1 mm. long, fusiform to allantoid in shape and jet-black, forming a superficial, laterally attached fructification, situated generally near either one or both ends of the stroma. The roof of the ascocarp is convex, consisting of heavily carbonized cells and opens by an irregular, medial,

longitudinal slit. The parenchymatous cells composing the basal plate are carbonized, but not so pronouncedly as the roof tissue. A radial development of the ascomata is clearly observable in young ascocarps and along the margins of older fruiting bodies. The asci are narrowly clavate, short-stalked, hyaline, unicellular, measuring 55 to 69 by 10 to 12 μ, and contain eight ovoid ascospores, pointed at one end, 13·8 to 14·5 by 4·5 μ at the widest point. These features suggest affinity with the Hemisphaeriales as classified by Theissen and Sydow and the fungus may be considered to represent a somewhat eccentric approximation to the Polystomellaceae.

On the basis of this work, a new species, *Ciliochorella bambusarum*, is erected to represent the pycnidial stage of the fungus; and the lateral attachment of ascomata to a pycnidial stroma is held to constitute so characteristic a feature, hitherto undescribed, as to justify setting up a new genus under the designation *Lateropeltis*, with *L. bambusarum* as the type species.

FISCHER (H.). **Untersuchungen über Massaria macrospora (Desm.) Sacc., ihre Nebenfruchtform Coryneum macrosporum Berk. und Asterosporium hoffmanni Kze.** [Studies on *Massaria macrospora* (Desm.) Sacc., its imperfect state *Coryneum macrosporum* Berk., and *Asterosporium hoffmanni* Kze.]—*Phytopath. Z.*, xiv, 5, pp. 512–517, 8 figs., 1944. [Received August, 1946.]

Massaria (*Cucurbitaria*) *macrospora*, a weak parasite of the beech in Switzerland, is transferred by the author from the Sphaeriales to the Pseudosphaeriales on the grounds that its 'paraphyses' are united with the stroma covering the ascus layer, in contradistinction to the true paraphyses of the Sphaeriales, which mostly do not project above the asci and in any case are free at the top, according to Gäumann's description [*R.A.M.*, v, p. 683]. Neither on dead beech branches, on the sites of inoculation on beech and *Carpinus betulus*, nor in agar cultures from ascospores of *M. macrospora* or conidia of its imperfect state *Coryneum macrosporum* were pycnidia or pycnospores of *Diplodia faginea* detected, and hence the position of the last-named as a state of *M. macrospora* is regarded as doubtful. No evidence could be found, moreover, of the supposed relationship between *M. macrospora* and *Asterosporium hoffmanni*, which was accepted by Grove [ibid., xvii, p. 68].

BAVENDAMM (W.). **Valdensia heterodoxa, ein neuer Buchenschädling.** [*Valdensia heterodoxa*, a new Beech parasite.]—*Forstw. Zbl., 1944*, 1, pp. 54–60, 3 figs., 1944. [Abs. in *Neuheiten PflSch.*, xxxvii, 3, pp. 86–87, 1944. Received 1946.]

Valdensia heterodoxa, originally described from Italy by Peyronel in 1923 [*R.A.M.*, iii, p. 487], has assumed an epidemic form on young beeches in the Vogtland, Germany, causing a brown discoloration and wilting of the leaves and a gradual die-back of the young shoots. Bilberries [*Vaccinium myrtillus*] were similarly affected. The pathogen evidently thrives only in the interior of relatively sparsely planted stands, and where beeches were free from infection bilberries also remained healthy. Although up to 40 per cent. of the trees were diseased in one 'compartment' [of 50 to 62 acres], the actual damage at the time of writing was not regarded as excessive. The fungus, however, is extending its range, having been reported from Poland, the U.S.S.R., and Latvia, and occurs on 31 hosts.

FRÖHLICH (J.). **Über den Befall der Fichte in den Ostkarpathen durch Trametes pini.** [On the attack of the Spruce in the eastern Carpathians by *Trametes pini*.]—*Z. ges. Forstw.*, lxix, 4–6, pp. 152–156, 3 figs., 1943. [Abs. in *Neuheiten PflSch.*, xxxvii, 2, p. 47, 1944. Received March, 1946.]

Old spruce trees in mixed stands with beeches and firs [*Abies*] at medium elevations (600 to 1,200 m. above sea-level) in the eastern Carpathians sustain

heavy damage from *Trametes* [*Fomes*] *pini*, the inconspicuous fruit bodies of which are readily overlooked. The fungus completely destroys the heartwood but leaves the sapwood intact, so that the water supply is not immediately interrupted. Only the upper 6 to 10 m. of the relatively low-grade crown wood of diseased spruces 40 to 50 m. in height are fit for manufacturing purposes. The infected trees cannot be saved, but are left standing owing to the high local costs of felling and transport, and they are, moreover, of little use as firewood. Firs appear to be immune from *F. pini* in the region under observation, where they are attacked only by the comparatively innocuous *Aecidium elatinum* [*R.A.M.*, x, p. 361].

[DAY (W. R.).] **Forest pathology.**—*Rep. imp. For. Inst., Oxford, 1944–45*, pp. 8–10, 1946.

Further work on the die-back and needle-cast of Corsican pine [*Pinus nigra* var. *calabrica*] in the west and north of England and Wales [*R.A.M.*, xxiv, p. 210] fully confirmed previous conclusions as to the importance of frost in the etiology of the disease. One further case of needle-cast in which *Hypodermella sulcigena* was involved has been reported from the north of England, while the same form of the trouble, often sparing the basal quarter or fifth of the needle, has also been found associated with *Sclerophoma pithyophila* [ibid., xvi, p. 427] in North Wales. Four species of fungi are now known to have occurred on needles with symptoms of the disease, and it is probable that some other factor is primarily responsible for the condition.

A serious die-back of larch observed in Scottish forests was clearly of the same nature as that occurring in England and Wales [ibid., xxiii, p. 200], and here again frost is undoubtedly a predisposing factor in the development of the disease.

Fomes annosus appears to be the agent of a dying-off of 22-year-old Scots and Corsican pines in East Anglian plantations, while a species of *Phytophthora* is indicated as the primary parasite in a similar locally important disorder of Japanese larches [*Larix leptolepis*] in Llantrissant Forest, Wales.

DELEVOY (G.). **À propos d'un cas de virulence exceptionelle d'Armillaria mellea (Vahl) Quél.** [On a case of exceptional virulence of *Armillaria mellea* (Vahl) Quél.]—*Bull. Soc. for. Belg.*, liii, 4, pp. 104–114, 1946.

In 1926–7 a plantation of spruces at Offagne, Belgium, which had already been partly cleared owing to infection by *Septoria parasitica* and where the remaining trees showed severe attack by *Fomes annosus*, was cut down and replanted in 1931–2 with Japanese larch (*Larix leptolepis*). In 1933 the larches began to die off, and by 1941 three-quarters of them had been replaced by birches and oaks. The remaining larches, except for a few healthy ones, died off in turn, withering up suddenly, after showing exudations of resin on the trunks and branches. In 1934–5, when the rest of the plantation was cut down, the stumps were removed.

Groups of Japanese larches were planted in parts previously uninfected but 20 per cent. were lost in under ten years. On the other side of a path on healthy land, spruces were planted in 1936, since when single individuals and small groups have turned yellow and suddenly withered and died.

All these losses appeared to be due to *Armillaria mellea* [*R.A.M.*, xxiv, p. 257], the mycelium of which was found in the affected trees. There were no factors to which this exceptional virulence of *A. mellea* could be attributed. Resinous exudations were observed at the foot of the trees, but they were not copious. Bark swelling was not conspicuous and was seldom present at a height of more than 60 cm. from the ground. The trees, however, had reacted strongly; resin was present along the entire length of the trunks, and the branches showed numerous resin droplets exuded from cavities present in the bark, where there was no mycelium. Larches 15 years old and 5 to 6 m. high showed marked enlarge-

ment of the resiniferous canals of the bark, which outwardly resembled small pustules.

White (W. H.) & Doolittle (S. P.). **A vegetable gardener's handbook on insects and diseases.**—*Misc. Publ. U.S. Dep. Agric.* 605, 30 pp., 10 figs., 1946.

The principal pests and diseases of vegetable-garden crops are listed under their several hosts (arranged in alphabetical order of the common names), with brief descriptions, notes, and directions for control. A concluding section deals with general methods of control and includes a number of standard formulae and other useful information connected with spraying and dusting operations.

Lamprecht (H.) & Hertzman (N.). **Immuna II, ny mot klumprotsjuka mycket motståndskraftig stam av Rova.** [Immuna II, a new strain of Swede highly resistant to club root.]—*Agri. Hort. Genet.*, i, 1–2, pp. 31–33, 1 fig., 1943. [German and English summaries.]

Immuna II, strain No. 26, is a swede developed at the Weibullsholm Plant Breeding Institute, Landskrona, Sweden, from the cross (Marienlyst V × Red-headed Bortfelder) × Immuna, which combines a high degree of resistance to club root [*Plasmodiophora brassicae*: *R.A.M.*, xx, p. 439] with heavy cropping.

Ledingham (R. J.). **The effect of seed treatment and dates of seeding on the emergence and yield of Peas.**—*Sci. Agric.*, xxvi, 6, pp. 248–257, 1 graph, 1946.

Tests from 1943 to 1945 at Saskatoon, Saskatchewan, where peas are not grown commercially and little information on their disorders is available to domestic cultivators, showed that emergence of pea seed treated with dust fungicides was best in early-sown varieties and deteriorated with later plantings, and in the main the results agreed with past experience in England and America, viz., the value of seed treatments is largely dependent on seed and environmental conditions. Progressive decreases in emergence in Saskatchewan after the excellent results of the earliest plantings could not be attributed to changes in soil moisture or to rain shortly after planting. Temperature rose more or less regularly as the season advanced, but its relationship to emergence is not simple [cf. *R.A.M.*, xxiii, p. 511]. There may be a delicate adjustment between soil temperature and the causal pathogens of pre-emergence blight (*Pythium ultimum* and other species), the data showing a sharp fall between the first and second sowings, during which the temperature was relatively stable. The reason may lie in the delay of *P. ultimum* and other pre-emergence pathogens to become active before late spring, by which time the primary plantings have outlived the susceptible stage. The results of his experiments lead the author to conclude that soil temperature must be regarded as a determining factor in the emergence of garden peas. Smooth-seeded field peas appeared to be more favoured by higher temperatures than garden peas during their germination period.

All the treatments tested proved effective, with possibly some advantage in the case of the mercurial dusts, ceresan and semesan.

Reid (W. D.). **Resistance of Beans to halo-blight and anthracnose and the occurrence of Bean-mosaic and Bean-weevil.**—*N.Z.J. Sci. Tech.*, A, xxvii, 4, pp. 331–335, 1 fig., 1945.

None of the 72 bean (*Phaseolus vulgaris*) varieties, comprising 137 dwarf and runner lines, tested for resistance to halo blight (*Pseudomonas medicaginis*) and anthracnose (*Colletotrichum lindemuthianum*) [*R.A.M.*, xxv, p. 199] in 1943–4 and 1944–5 was immune from both diseases, though all the white-seeded and runner varieties were highly resistant, as also were Golden Wax, Pink, Pinto, Tennessee, Red Mexican, and Red Valentine. The Pink, Zebra, and Oregon Giant varieties

developed no halo blight, while Small White, Burbank, and Ideal Market were free from anthracnose. Of eight varieties attacked by the bean-mosaic virus, only two were derived from seed used in the previous series of trials.

Dean (L. L.) & Hungerford (C. W.). **A new Bean mosaic in Idaho.**—*Phytopathology*, xxxvi, 4, pp. 324–326, 1946.

A new strain of the common bean [*Phaseolus vulgaris*] mosaic virus characterized by its pathogenicity to the ordinarily resistant Great Northern U.I. 15 variety was observed in Idaho in 1943 and shown by inoculation experiments on local seed and that of the same varieties used by Richards and Burkholder in their studies on a similar disease in New York [*R.A.M.*, xxiii, p. 207] to be identical with the latter. The University of Idaho Red Mexican selections 3 and 34, as well as Pinto and several of its derivatives, are susceptible to the new strain but resistant to the common bean-mosaic virus, Great Northern U.I. 1, 56, 59, 81, and 123 are resistant to both, Michelite, Robust, Red Kidney, Bountiful, and Burtner are susceptible to the new strain, and Idaho Refugee and U.S. No. 5 resistant.

Kišpatić (J.). **Einleitende Versuche über Rassenbildung bei Uromyces fabae (Pers.) de Bary.** [Introductory experiments on race formation in *Uromyces fabae* (Pers.) de Bary.]—*Phytopath. Z.*, xiv, 5, pp. 475–483, 5 figs., 1944. [Received August, 1946.]

From three collections of *Uromyces fabae* from Germany 16 monospore lines were isolated and tested on 14 commercial broad bean varieties, of which seven showed an appreciable degree of resistance, viz., Butjadinger Ackerbohne, Füllbergs Hochzucht Feldbohne, Dr. Francks Hohenloher Ackerbohne, Rosenhofer Feldbohne, Herz Freya Ackerbohne, and Rastatter Ackerbohne Stamm 1 and Stamm 8, while two were highly susceptible, Breustedts Schladener Kleine Feldbohne and Strubes Schlanstedter Ackerbohne. The outcome of these preliminary tests is considered to point to the existence of physiologic races of the rust [cf. *R.A.M.*, xiii, p. 670].

Allington (W. B.). **Bud blight of Soybean caused by the Tobacco ring-spot virus.**—*Phytopathology*, xxxvi, 4, pp. 319–321, 2 figs., 1946.

The reduction in the 1943 and 1944 soy-bean crops in the mid-western States of the American Union caused by the tobacco ring-spot virus [*R.A.M.*, xxiv, p. 133] exceeded all previous records. In addition to the symptoms already noted for Illinois, mention may be made of the unusual prominence and darkening of the pubescence on the young stem tip, necrosis and brittleness of the growing point, occasional streaking of the petioles and large leaf veins, and (in the case of late infection) dark blotching of the pods, sometimes followed by the shrivelling and dropping of a high percentage of young clusters within ten days of the attack.

The soy-bean virus produced typical ring-spot symptoms on tobacco, and the effects of inoculation with the strains from both these hosts on Red Kidney beans (*Phaseolus vulgaris*) and cucumber were indistinguishable, the resultant severe stunting and mottling persisting indefinitely. The thermal inactivation point of the soy-bean virus corresponded precisely with that of tobacco ring-spot, viz., 65° C. (ten minutes' exposure). The rapid spread of the disease through the soy-bean fields is probably due to insect agency.

Smith (F. G.), Walker (J. C.), & Hooker (W. J.). **Effect of hydrogen-ion concentration on the toxicity to Colletotrichum circinans (Berk.) Vogl. of some carboxylic acids, phenols, and crucifer extracts.**—*Amer. J. Bot.*, xxxiii, 5, pp. 351–356, 3 graphs, 1946.

This biochemical examination of crucifer tissues to determine the nature of resistance to club root (*Plasmodiophora brassicae*) includes an examination of their toxicity to spores of *Colletotrichum circinans* [*R.A.M.*, xxv, p. 380] and a com-

parison of this toxicity with that of typical phenols and carboxylic acids. The results show that the pathogenicity of ether-soluble, strong acid fractions of crucifer extracts was correlated with pH. The carboxylic acids exhibited almost parallel linear curves, the decreasing order of toxicity being benzoic, protocatechuic, and acetic acids. Hydroquinone and catechol were markedly different from the acids, the toxicity of the former notably increasing at pH 7, and a comparison with that of the corresponding P-quinone suggests that autoxidation to quinone had occurred. The curves for crucifer extracts suggest that carboxylic acids or similar toxicants are mainly responsible for toxicity. Two possible mechanisms are suggested by these experiments whereby relatively small variations in pH may bring about marked modifications in fungicidal activity important in natural disease resistance or in the application of commercial fungicides.

RAMSEY (G. B.), HEIBERG (BARBARA C.), & WIANT (J. S.). **Diplodia rot of Onions.**—*Phytopathology*, xxxvi, 4, pp. 245–251, 3 figs., 1946.

Texas-grown, white-skinned Crystal Wax onions were observed for the first time on the Chicago market in 1938 to be infected by *Diplodia natalensis* [*R.A.M.*, xix, p. 110], causing a silvery-grey discoloration of the outer dry scales round the upper half of the bulbs or occasionally all over them, while the necrotic portions of the outer fleshy scales were also often invaded, becoming black and leathery. In no case, however, was involvement of the internal fleshy scales detected.

The onion isolate of the fungus, which produced on potato dextrose agar pycnospores ranging from 20 to 28·4 by 10·2 to 17·7 (average 23·6 by 12·8) μ, was compared with 12 others from six hosts, namely, avocado, coco-nut, orange, groundnut, sweet potato, and watermelon: no essential differences necessitating specific separation were found. Cross-inoculation experiments with the onion strain gave positive results on sweet potato, apple, and orange, thereby confirming the conclusions of other workers as to the morphological and symptomatological similarity of *Diplodia* isolates from a wide variety of hosts [ibid., xx, p. 278 *et passim*]. The minimum, optimum, and maximum temperatures for the growth of the onion isolate in pure culture were 50°, 85°, and 104° F., respectively.

A chemical, probably protocatechuic acid, associated with the pigments in aqueous extracts of the dry outer scales of coloured varieties (which are not affected by the rot) proved toxic to the spores of *D. natalensis* from white onions [cf. ibid., ix, p. 284; xxv, p. 380]. The amounts of this substance in white onion scabs are insufficient to prevent the germination of spores of the pathogen. Little difference was found between the coloured and white varieties in respect of the acidity of the dry and fleshy scales (pH 4·4 to 4·5 and 5·7 to 5·9, respectively), and the fungus made good growth within these ranges, showing that the hydrogen-ion concentration of the tissues is not the primary factor in restricting pathogenicity to white-skinned onions.

These studies, supplemented by market observations during the past seven years, indicate that *D. natalensis*, though not actively parasitic on white onions, may considerably reduce the commercial value of the southern crop.

BRIERLEY (P.) & SMITH (F. F.). **Reaction of Onion varieties to yellow dwarf virus and to three similar viruses isolated from Shallot, Garlic, and Narcissus.**—*Phytopathology*, xxxvi, 4, pp. 292–296, 1946.

Of 27 onion varieties mechanically inoculated with the onion yellow-dwarf virus [see next abstract] and related isolates from shallot (Louisiana) [cf. *R.A.M.*, xxiv, p. 133], garlic (Oregon), and narcissus [daffodil] (*Narcissus*) [*pseudonarcissus*] King Alfred variety (material supplied by F. A. Haasis), ten were immune from the yellow-dwarf, garlic, and daffodil viruses, viz., Early Yellow Babosa, White Babosa, Utah Sweet Spanish, Yellow Sweet Spanish, Crystal Wax, Lord Howe Island, San

Joaquin, Yellow Bermuda, Nebuka (*Allium fistulosum*), and a Beltsville amphidiploid, Nebuka × White Portugal, and 17 susceptible. The shallot virus, on the other hand, was pathogenic to every variety except Nebuka and the abovementioned amphidiploid, these two green-bunching types thus being immune from the four viruses under observation, all of which proved to be transmissible by *Myzus persicae*.

Brierley (P.) & Stuart (N. W.). **Influence of nitrogen nutrition on susceptibility of Onions to yellow-dwarf virus.**—*Phytopathology*, xxxvi, 4, pp. 297–301, 1 fig., 1946.

In 1944–5 four onion varieties, Ebenezer, Utah Sweet Spanish, Creole, and Stockton Yellow Globe, grown at high (60 p.p.m.) and low (6 p.p.m.) weekly initial nitrogen levels in 'haydite', were inoculated with the yellow-dwarf virus [see preceding abstract] from naturally infected multiplier onion (*Allium cepa* var. *solaninum*) from West Virginia [*R.A.M.*, xxiii, p. 469]. The percentages both of symptom expression and actual infection were smaller, in a highly significant degree, at the lower nitrogen level. The recognized immunity of Utah Sweet Spanish was unimpaired by 17 inoculations between 24th October and 17th April at the high nitrogen level, which on the other hand increased the incidence of infection both in the highly susceptible Ebenezer and the fairly resistant Creole and Stockton Yellow Globe. Thus, the incidence of yellow dwarf in Ebenezer had risen from 94·3 per cent. at the first count on 14th November to 100 at the third on 23rd January, the corresponding figures for Stockton Yellow Globe, Creole, and Utah Sweet Spanish being from 30·3, 18·2, and 0 to 93·1, 83·8, and 0, respectively, at the eighth count on 11th June.

Yarwood (C. E.). **Isolation of Thielaviopsis basicola from soil by means of Carrot disks.**—*Mycologia*, xxxviii, 3, pp. 346–348, 1946.

The high susceptibility of carrot has encouraged the author to attempt to isolate *Sclerotinia sclerotiorum* from soils and plant debris by means of a living carrot disk technique. Very few isolations of *S. sclerotiorum* were secured, but in 66 out of 240 tests *Thielaviopsis basicola* was freely obtained from several soils in the San Francisco Bay and Santa Clara Valley areas, and notably from an ornamental garden in Berkeley and an apricot orchard near Hollister.

Soils from field collections were spread over carrot root disks 5 mm. thick in Petri dishes, enough water being added by atomizing to moisten the soil without allowing the formation of free water. After two to four days at room temperature the disks were washed free of soil and incubated in moist chambers. When soils containing *T. basicola* were used as inoculum, greyish colonies appeared about six days later. Primary formations of endoconidial colonies turned almost black to form prolific macroconidial populations, and pure cultures of *T. basicola* followed transfers from the aerial mycelium to potato dextrose agar. The disks showed no apparent discoloration or decay until ten days after inoculation, and the mycelium was microscopically observed to have invaded the areas between and within the cells without disintegrating them until penetration was far advanced. When dilute spore suspensions from pure cultures were employed and the carrot disks were, in consequence, not washed following inoculation, colonies could be counted in three days. In none of the areas from which soil samples were drawn was the fungus observed as parasitic on crops.

Pryor (D. E.). **Exploratory experiments with the big-vein disease of Lettuce.**—*Phytopathology*, xxxvi, 4, pp. 264–272, 1946.

Experiments involving three species of leaf-feeding aphids, *Macrosiphum solanifolii*, *Myzus convolvuli*, and *M. persicae*, various methods of mechanical inoculation,

lettuce seed soaked in diseased leaf juice, and seed harvested from infected plants, gave inconsistent results in respect of big-vein [*R.A.M.*, xxiv, p. 135] transmission. The addition of unfiltered lixiviate from infective soil to disease-free soil induced big vein in 4 out of 83 plants grown thereon, whereas the filtered lixiviate was innocuous. Leaching failed to eliminate the virus from the soil. In two tests big vein developed in plants grown on soil to which chopped diseased leaves were added, 5 out of 48 being affected in the first and 5 out of 40 in the second, while all in the control plots remained healthy.

There was little difference in the incidence of big vein developing in transplants and in lettuce sown directly in infective soil. Trials in which one diseased plant was grown for 2 to 2½ months adjacent to three healthy plants in a 6-in. pot filled with non-infective soil indicated that the virus travelled very slowly, if at all, through the undisturbed soil during that time. Transplanting lettuce at intervals from infective to non-infective soil showed that some big vein develops within a fortnight of sowing, but under the experimental conditions at least four weeks' growth in infective soil was necessary to induce symptoms in a high proportion of the plants. In exploratory tests the dilution of 1 part of big-vein soil with 800 of autoclaved soil only slightly reduced the incidence of infection. Stored, air-dry soil has been found to retain its virulence for at least eight years.

A soil temperature of 22° C. was most conducive to the development of big vein in five out of seven tests, the optima in the other two being 26° and 18°; some infection occurred throughout the range from 14° to 30°. Air temperatures, however, also appear to be concerned to some extent in the expression of big-vein symptoms, and further studies are required to elucidate their effects, both independently of, and combined with, those of soil temperatures.

Săvulescu (T.). **Rumania. Downy mildew of the Vine during 1940.**—*Int. Bull. Pl. Prot.*, xv, 7–8, pp. 134 M–141 M, 1941. [Received July, 1946.]

Owing to the prevailing weather conditions, downy mildew of the vine (*Plasmopara viticola*) was very severe in Rumania in 1940; in many parts of the country the harvest was entirely lost. Infection developed not merely on the leaves and bunches, but on the tendrils and young shoots, the growth of which was stunted.

Depardon (L.). **Les hybrides producteurs directs dans la région du Centre.** [Ungrafted Vine hybrids in the central district.]—*C.R. Acad. Agric. Fr.*, xxvii, 12, pp. 670–678, 1941. [Received August, 1946.]

In these notes on the ungrafted vine hybrids cultivated in central France it is stated that Seibel 5.455 shows good resistance to mildew [*Plasmopara viticola*] and fair resistance to court-noué. Seibel 8.365 is one of the most resistant to *P. viticola*. Seibel 8.357 is very resistant to *P. viticola* and appears to be resistant to court-noué. Seyne-Villard 12.426 seems to be virtually immune from *P. viticola*. Among white hybrids, Seibel 4.986 and 11.803 rosé are very resistant to *P. viticola*, while Seyne-Villard 5–276 is completely resistant. Seibel 10.173 shows resistance of the fruit berries to rot, but its leaves are rather susceptible to mildew.

Arnaud (G.). **Traitement du mildiou de la Vigne. Aspect actuel de la question.** [The treatment of Vine mildew. The present state of the question.]—*C.R. Acad. Agric. Fr.*, xxvi, 21, pp. 716–721, 1940. [Received August, 1946.]

After pointing out that economies in the use of copper against vine mildew [*Plasmopara viticola*] are to be sought mainly in improving the methods of application, and only secondarily amongst suitable substitutes for copper, the author states that Bordeaux and Burgundy mixtures are, on the whole, irreplaceable as regards cost and effectiveness, but certain cupric products can be used to supple-

ment them. Application of copper mixtures (especially Bordeaux mixture) can be improved by a more judicious selection of the dates of spraying and by adopting a more effective spraying technique. The fixed spray-jets involve a loss of one-third or one-half of the spray fluid, which could be obviated by using jets on flexible tubes held in the hands. There is no substitute for Bordeaux and Burgundy mixtures at present, but nickel and possibly cobalt appear to be effective against *P. viticola*. Vine-growers should never be advised to reduce the amount of copper used unless it is certain that the alternative suggested will prove successful.

DUBAQUIÉ. **Essais de traitement contre le mildiou par l'ammoniure de cuivre. Bordeaux 1941.** [Trials of treatment against mildew with cuprammonia. Bordeaux 1941.]—*C.R. Acad. Agric. Fr.*, xxvii, 6, pp. 900–902, 1941. [Received August, 1946.]

In tests of cuprammonia against vine mildew [*Plasmopara viticola*] carried out by the Abbé Dubaquié on an area of 150 ha. in the vicinity of Bordeaux the undiluted material ('ammoniure cellulosique': mean content, 15 to 20 gm. copper and an equal weight of cellulose per l.) for the spray was handed to the growers, who added a sufficient quantity of the water used by them for general purposes to make a solution containing 25 gm. copper per hl. Each grower used the spray to replace one or more treatments with Bordeaux mixture ($1\frac{1}{2}$ or 2 per cent.), so that on every occasion when the substitution was made there was an economy in copper of 15 or 20 to 1. No directions were given as to spraying.

The results obtained were as follows. The vines treated once or more with cuprammonia and given a final application of Bordeaux mixture in August gave a crop as free from infection as that obtained from the vines treated throughout with Bordeaux mixture, the crop was equally good, and the foliage and wood were slightly better. The vines treated exclusively with cuprammonia gave a crop as free from mildew as that given by any other treatments, but when the cuprammonia was applied after 10th August during rainy weather, leaf scorch resulted, sometimes followed by premature fruit-drop. Further work was arranged to study the question of these late applications. The author recommends that the preparation of cuprammonia should be undertaken on a large scale immediately. [In commenting on this paper, G. BERTRAND discusses (pp. 902–904) problems of control requiring further study.]

BARRAUD (Mlle M.). **Le mildiou de la Vigne. Essais du 1er degré à La Grande Ferrade. (Rapport sur les travaux effectués et les résultats obtenus en 1943.)** [Vine mildew. First-degree trials at La Grande Ferrade. (Report on work done and results obtained in 1943.)]—*Ann. Épiphyt.*, N.S., xi, 1–2, pp. 105–114, 1945.

During 1943, infection by vine mildew [*Plasmopara viticola*] was very light at La Grande Ferrade, affecting only the leaves. Spraying and dusting trials with 15 different materials applied at dates recommended by the local spray-warning service showed again that products containing copper gave the best results, Bordeaux mixture at 1 and 0·4 per cent. and copper oxychloride at 250 gm. per hl. affording satisfactory protection to the foliage, which was still virtually unaffected as late as 25th October.

GAUDINEAU (Mlle M.) & BARRAUD (Mlle M.). **Années à faible mildiou et traitements des Vignes.** [Years of slight mildew and Vine treatments.]—Reprinted from *C.R. Acad. Agric. France*, ccxxii, 9th January, 3 pp., 1946.

In 1944 and 1945, weather conditions were unfavourable in France to attacks of vine mildew [*Plasmopara viticola*]. In the former year, Bordeaux mixture 4 and

2 per cent. gave slightly better results than at 1 per cent., in 1945 concentrations of 1 and 2 per cent. were about equally effective. Only one spray application was made in 1944, on 18th July, and materials low in copper, such as product W (an organic material containing 2·5 per cent. copper) did not protect the leaves against infection in August, but in 1945, when treatments were made on 4th July and 7th August, their effect was adequate. Spraying promoted the retention of leaves until October, those on untreated vines falling in early or mid-September, the Bordeaux mixtures being most effective in this respect.

That early copper treatments are advisable even when conditions do not favour *P. viticola* is indicated by the fact that black rot [*Guignardia bidwellii*] has become increasingly prevalent since 1942 and has reappeared in south-western France, where it had previously been kept in check for 40 years by regular treatments against mildew. In years of slight infection, therefore, when no treatment is needed before the berries ripen a spray of a low copper concentration should be applied early in August to preserve the foliage, help the ripening of the wood, and prevent any recrudescence of the disease.

Lafon (J.). **Expérimentation en serre de produits contre le mildiou de la Vigne.** [Greenhouse tests of products against Vine mildew.]—*Rev. Vitic., Paris*, xcii, 6, pp. 174–176, 2 figs., 1946.

The author describes a greenhouse method for the preliminary testing of materials intended for use against vine mildew (*Plasmopara viticola*). Winter spores on fragments of leaves were germinated at 25° C. When the conidia appeared, young leaves of potted vine cuttings were inoculated by the usual methods to provide inoculum. The test cuttings were sprayed individually on both leaf surfaces with the various test materials. Next day the upper and lower leaf surfaces and the whole cutting were sprayed with double-distilled water containing numerous conidia. Each potted cutting was then kept under very moist conditions so that an adequate humidity was maintained for infection to take place and to facilitate the development of the conidiophores.

All inoculations so made gave positive results in spring, summer, and autumn, the untreated controls and plants sprayed with ineffective materials becoming entirely covered with mildew, conidiophores developing even on the herbaceous stems, the petioles, and along the veins on the upper surface of the leaves.

This method is useful for the rapid elimination of materials found to be unsatisfactory. Promising materials can then be tested under field conditions.

Pastac (J. A.). **La bouillie bordelaise a-t-elle trouvé un remplaçant?** [Has Bordeaux mixture been displaced?]—*Rev. Vitic., Paris*, xcii, 3, pp. 72–75; 4, pp. 107–111, 1946.

Discussing the chemical nature of materials likely to be of use against vine diseases, the author states that copper salts are unable to arrest the mycelium of *Oidium* [*Uncinula necator*], but they can inhibit the zoospores and young mycelium of mildew [*Plasmopara viticola*]. Owing to the absorbing power of the mildew plasma very small quantities of copper salts in solution are sufficient to prevent infection [by *P. viticola*]. The exceptional position which copper fungicides occupy to-day among even stronger antiseptics (formalin, malachite green, etc.) is attributable to their stability, adhesive powers, and resistance to meteorological factors. Their action is lasting and every fresh attack by mildew meets traces of copper products on treated plants.

The author reviews the stability and means of stabilizing dyes (since their fungicidal value depends on this), the known antiseptic action of malachite green, the effect of copper salts as compared with that of organic dyes, the dosages of fungicidal dyestuffs, and the materials which might replace Bordeaux mixture.

Such a material should be stable, adhesive, and only slightly soluble, properties which may be conferred upon basic dyes by chemical treatment.

The 2,4-dinitrocresol used as a winter treatment for fruit trees and vines, when applied to vines in summer, burns the foliage, particularly the infected areas, and this indicates that at a lower concentration it might be useful against mildew.

Barraud (Mlle M.) & Gaudineau (Mlle M.). **Oidium de la Vigne. Essais de traitements en 1944.** [Vine *Oidium*. Experimental treatments in 1944.]—*Ann. Épiphyt.*, N.S., xi, 1–2, pp. 121–138, 1945.

During 1944, when attacks by vine *Oidium* [*Uncinula necator*] were severe locally, spraying and dusting trials carried out at La Grande Ferrade on the Cabernet-Sauvignon Muscadelle and Malbec varieties showed that the best results were given by sublimated sulphur. This material should always be applied to the foci of infection at the renewal of growth when a severe outbreak threatens. Natural ores enriched by the addition of pure sulphur increased in effectiveness with increasing sulphur content, that containing 30 per cent. sulphur giving good results. The waste product from coal gas, containing about 18 per cent. sulphur, was rather better than sulphur ore enriched to 20 per cent., and sometimes equalled that with a 30 per cent. sulphur content. Sulphosodium mixture (250 gm. sulphur per l., used at 1 per cent.) was extremely effective. Lime-sulphur (230 gm. sulphur per l., used at 2 per cent.) might be useful when sulphur is unobtainable or in cool weather. If colloidal sulphur is used (85 per cent. sulphur) it must be applied at a rate of over 250 gm. per hl. Wetters containing terpenic alcohols [*R.A.M.*, xviii, p. 17] added to Bordeaux mixture 2 or even 1 per cent. gave promising results, and this mixture is recommended for the fruit bunches instead of Bordeaux with potassium permanganate, which is useless unless followed by a sulphur treatment.

Curran (M.). **Action anti-Oidium des mouillants à base d'alcools terpéniques.** [The anti-*Oidium* action of wetters containing terpenic alcohols.]—*Rev. Vitic., Paris*, xcii, 3, pp. 84–86; 5, pp. 143–145; 6, pp. 169–173; 5 figs., 11 graphs, 1946.

The author's laboratory investigations [which are described in detail] show that the fungicidal power *in vitro* against spores of *Uncinula necator* of wetters containing sulphonated terpenic alcohols [see preceding abstract] is greater than that of lime and distinctly superior to that of copper sulphate. All the conidia submerged in a 0·3 per cent. solution were killed in two hours, the numbers surviving in copper sulphate solution (1 per cent.) and lime water (saturated) after the same period being 28 and 18 per cent., respectively. In nature, however, copper, like lime, has the advantage of not evaporating, and it may possess towards the conidia of *U. necator* the same power of inhibiting germination that it shows towards the spores of downy mildew [*Plasmopara viticola*]. The anti-*Oidium* power of Bordeaux mixtures with a wetter containing terpenic alcohol is attributed to the complete and homogeneous spread of the copper and lime over the plant so that the fungus cannot find a place favourable for development. The terpenic alcohols (even if they do not possess all the qualities necessary to provide by themselves an effective treatment) are considered to play an active and an individual part against *Oidium*. When terpenic alcohols are used in preparations that are chemically well balanced and under conditions that allow them to contact the fungus for a sufficiently long period, they bring about the death of *U. necator* spores, firstly by surrounding them with an insulating layer which asphyxiates them, and, secondly, they are able either to dissolve certain elements in the plasma membrane or to penetrate and rupture it, so bringing the cytoplasm fairly rapidly into contact with fungicidal materials. Of these two processes the second, owing to the rapidity and intensity of its effects, is mainly responsible for the anti-*Oidium* action of the terpenic

alcohols, but it appears that the wetter should be in a state of emulsion; this does not last long, being related to the period of evaporation of the water. Afterwards, only the insulating capacity is effective and then only for a certain time.

In one field trial on vegetable marrow suffering from *Oidium* [*Erysiphe cichoracearum*], using terpenic alcohol wetter (at 3 parts per 1,000), dissolved either in distilled water or in lime water (5 per cent.), the number of living conidia on the leaves was reduced from between 50 and 59 to 11 per cent.

Limasset (P.). **Les maladies à virus des plantes et le problème du court-noué.** [Virus diseases of plants and the problem of court-noué.]—*Rev. Vitic., Paris,* xcii, 5, pp. 134–139, 1946.

After briefly reviewing the characteristics of plant virus diseases in general, the author discusses with particular reference to the views of Branas [*R.A.M.*, xix, pp. 66] the question of the possible virus nature of court-noué of the vine [see also ibid., xxii, p. 195]. He concludes that the hypothesis that the disease is of virus origin is supported by two arguments, that it is graft-transmissible and that in its symptoms it resembles certain virus diseases. That the disease assumed epidemic proportions only after the French vineyards had been invaded by *Phylloxera* [*vastatrix f. radicicola*] supports the view that court-noué may be transmitted by this insect. The other arguments brought forward by Branas in support of this view are regarded as untenable until supported by extensive experiments. While the author admits that there is a form of court-noué which is transmissible by grafting and produced by one or several viruses, he does not imply that *Pumilus medullae* [ibid., xxii, p. 196] plays no part in the disease. The probability in favour of a virus origin is particularly strong in the case of 'jaunisse' [yellowing: ibid., xvi, p. 18].

In relation to court-noué, official control of vine nurseries cannot be too strict. As a precautionary measure such nurseries should be established only in areas free from *Phylloxera*.

Tardivo (P.). **Une opinion sur les causes du court-noué.** [An opinion on the causes of court-noué.]—*Rev. Vitic., Paris,* xcii, 5, p. 146, 1946.

The author puts forward the view that the physiological type of court-noué disease of the vine [see preceding abstract] may in some instances be due to or favoured by unsuitable cultural practices and unbalanced soil conditions, including improper drainage and insufficient application of organic manure, even on good soils.

Wilhelm (A. F.). **Untersuchungen zur Frage einer chemischen Bekämpfung der Traubenfäule (Botrytis cinerea).** [Studies on the question of chemical control of Grape rot (*Botrytis cinerea*).]—*Wein u. Rebe*, xxvi, 4–6, pp. 29–49; 7–9, pp. 67–73, 3 figs., 1944. [Abs. in *Neuheiten PflSch.*, xxxvii, 5, p. 168, 1944. Received March, 1946.]

Bordeaux mixture, with and without soap, adhesives, and wetters, and a number of other proprietary preparations, did not give effective control of grape rot (*Botrytis cinerea*) in the author's experiments. The thermal death point of the conidia was found to be 44° C. When germinated in water the conidia were unable to infect unwounded vine leaves and grapes, but those in a nutrient medium penetrated the uninjured tissues. Wounded leaves and grapes were infected without the aid of nutriment. *B. cinerea*, therefore, is a wound parasite, not a facultative one. Bordeaux mixture completely fails to protect injured fruits because the toxic element in the copper is eliminated by the natural germination medium of the conidia, but it does reduce the incidence of infection on unwounded grapes.

The action of soap and various new adhesives and wetters is purely supplementary. A new line of approach to the problem should be sought, substituting organic compounds for metals.

DONCASTER (J. P.) & KASSANIS (B.). **The Shallot aphis, Myzus ascalonicus Doncaster, and its behaviour as a vector of plant viruses.**—*Ann. appl. Biol.*, xxxiii, 1, pp. 66–68, 1 pl., 1946.

A new species of aphid, *Myzus ascalonicus* Doncaster, found on shallots in storage, on onions, and on other plants in glasshouses and in the field between October and June, is described and compared with *M. persicae* Sulz., to which it bears a superficial resemblance. *M. ascalonicus* was found to transmit dandelion yellow mosaic virus [*R.A.M.*, xxiii, p. 372], of which *M. persicae* is not a vector, and also cucumber virus 1 [cucumber mosaic virus], *Hyoscyamus* virus III [henbane mosaic virus], and sugar beet yellows virus [beet yellows virus], all of which are transmitted by *M. persicae.* Potato virus Y, severe etch [tobacco etch virus], lettuce mosaic, and sugar beet mosaic are transmitted by *M. persicae*, but not by *M. ascalonicus*.

PETRI (L.). **Rassegna dei casi fitopatologici osservati nel 1940.** [Review of phytopathological records noted in 1940.]—*Boll. Staz. Pat. veg. Roma*, N.S., xxi, 1, pp. 1–56, 1941. [Received June, 1946.]

This report [cf. *R.A.M.*, xix, p. 68] contains numerous items of phytopathological interest, of which only a few can be mentioned here. Against vine mildew (*Plasmopara viticola*), severe outbreaks of which occurred, Casale's mixture [ibid., xxii, p. 52], prepared as a powder to which water is added when required, was outstanding; the results given equalled those obtained from ordinary Bordeaux and Burgundy mixtures, though the season was very rainy. Reports from Trieste stated that the vine disease due to *Phomopsis viticola* [ibid., xvii, p. 288] was spreading.

An entire olive plantation extending over about 40 ha. in Reggio Calabria was attacked by root rot (*Armillaria mellea*). Three five-year-old Precoce argenté peach trees imported from France developed a wilt due to mosaic [ibid., xxii, p. 439], not previously recorded on this host in Italy. All attempts to find *Phoma limoni* [ibid., xxv, p. 445] in Sicily during the spring and summer were unavailing; it was discovered in Liguria, but was very uncommon. The author is convinced that this species, which appears to be purely saprophytic, is confined in Italy to the north, where it occurs on ornamental lemons already damaged by some other cause. *P. limoni* is certainly not synonymous with *Deuterophoma tracheiphila*.

Wheat yields were reduced by unfavourable weather conditions and infection by *Erysiphe graminis*. The first uredosori of *Puccinia glumarum* were collected in the middle of May at Maccarese. Mentana wheat leaves affected by *P. triticina* and *P. graminis* were received in February from Gondar [Abyssinia]. In Friuli wheat was widely attacked by *Fusarium graminearum* [*Gibberella zeae*]. *Cladosporium herbarum* and *Alternaria tenuis* were commonly present on wheat in northern Italy and also in the province of Cagliari. Maize showing leaf spot due to *Helminthosporium turcicum* was received from the vicinity of Trieste; the varieties chiefly attacked were Marano Vicentino and de Wolff, grown in various parts of Friuli. Numerous specimens of maize leaves attacked by *P. maydis* were received from Umbria.

Beans (*Phaseolus vulgaris*) in Maccarese were severely attacked during two successive years by *Colletotrichum lindemuthianum*. Dutch and Lithuanian flax varieties showed very severe collar and root rot due to *Phytophthora cactorum*. Hydrangeas growing under glass were attacked by *Oidium hortensiae* [*Microsphaera polonica*: ibid., xxv, p. 451], only the inflorescences being affected.

Petri (L.). **Rassegna dei casi fitopatologici osservati nel 1941.** [Review of phytopathological records noted in 1941.]—*Boll. Staz. Pat. veg. Roma*, N.S., xxii, 1, pp. 1–62, 1 fig., 1942. [Received June, 1946.]

This report [cf. preceding abstract] contains numerous items of phytopathological interest of which the following may be mentioned.

Vine leaf roll ('arricciamento') [vine mosaic virus: *R.A.M.*, xvii, p. 727; xviii, p. 810], as determined by the presence of endocellular cordons, was observed on mother plants in Palermo, on Rupestris du Lot vines and Berlandieri hybrids, and in 26 bundles of cuttings from Trento, consisting of Volano grafted on Teleky. In one vine endocellular cordons were found seven months after grafting. In vine branches from two plantings of mother vines severely affected with leaf roll these formations were abundantly present. Cuttings taken from American vines in Palermo were also affected.

Pear leaves from Rome bore large yellow spots showing the pycnidia [spermogonia] and aecidia of *Gymnosporangium sabinae* [ibid., xx, p. 382]; junipers in the same locality bore teleutosori of the same fungus. Pear fruits of the Passa crassana, Decana d'inverno [winter], and Butirra Clairgeau varieties showed rotting due to an *Alternaria* of the *A. tenuis* group and to *Macrosporium commune* [? *Pleospora herbarum*: cf. ibid., xviii, p. 141]; the Louis Pasteur variety appeared to be highly resistant. Almonds were affected by *Clasterosporium carpophilum*. Loquats in different parts of Lazio showed infection by *Fusicladium dendriticum* var. *eriobotryae* [ibid., xix, p. 582]. Lemons at Quinto developed leaf infection by *Phyllosticta disciformis*. Citrons (*Citrus medica*) in Potenza developed a sudden wilt associated with *Deuterophoma tracheiphila*.

Branches of Aleppo pines [*Pinus halepensis*] near Genoa were affected by a progressive wilt due to the aecidial stage of *Cronartium ribicola*, and also showed the presence of *Sphaeropsis ellisii* [*Diplodia pinea*: ibid., xxi, p. 398] which caused a wilt of the younger branches. *Salix* sp. leaves showed spotting due to *Gloeosporium beckianum*. Lilac near Rome was affected by *Gloeosporium syringae* and *Pseudomonas syringae* [ibid., xix, p. 134] and oleander by *Bacterium tonellianum* [or *Pseudomonas savastanoi* var. *nerii*: ibid., xiii, p. 748; xxv, p. 251].

Wheat at Tiene developed foot rot due to *Leptosphaeria herpotrichoides* [loc. cit.], while at Pescara young wheat plants, following cold, became severely infected by *Erysiphe graminis*. Maize suffering from severe insect infestation developed root infection by *Rhizoctonia* and culm infection by *Helminthosporium turcicum* and *Fusarium* sp. Watermelons at Lucca were attacked by *F. bulbigenum* var. *niveum*; the disease affected an area of 10 ha., and had been growing progressively worse for four or five years. Beets near Naples showed severe leaf infection by *Uromyces betae*, while the roots were attacked by *Sclerotium rolfsii*. At Catanzaro and Crotone beet leaves developed infection by *Peronospora schachtii* [ibid., xxiii, p. 80]. Hemp stalks at Modena showed lesions due to *Botryosphaeria marconii*; as well as the ascigerous stage, the fungus also showed the conidial forms *Dendrophoma* [*D. marconii*: ibid., xxiii, p. 254] and *Macrophoma*, while a whitish layer due to secondary infection by a *Fusarium* was also present. Kentucky tobacco plants at Salerno showed root swellings probably due to *Pseudomonas* [*Bact.*] *rhizogenes*, apparently not previously reported on tobacco.

Padwick (G. W.). **India and Burma. New plant diseases recorded in 1939.**—*Int. Bull. Pl. Prot.*, xiv, 9, pp. 163m–164m, 1940. [Received July, 1946.]

This list of new plant diseases recorded in India and Burma in 1939 includes, *inter alia*, *Phomopsis* sp. causing a seedling wilt of tea in Assam.

Beattie (A. G.). **Annual Report, Agricultural Department, Nigeria, 1944.**—47 pp., 1946.

In the course of a survey in November, 1944, swollen shoot disease of cacao [*R.A.M.*, xxv, p. 441] was found in two separate localities in Oyo Province. In Adamawa and Niger Provinces groundnut rosette disease [ibid., xviii, p. 434] was widespread, but its incidence in the other principal groundnut-producing provinces was not abnormal.

Swollen shoot of Cacao. How to recognize and control.—[*Publn*] *West Afr. Res. Inst.*, 20 pp., 14 figs., 2 maps, 1945.

This paper describes control measures against swollen shoot disease of cacao [see preceding abstract] applied during 1940–1943 by the Department of Agriculture, Gold Coast, published in 1945, with an amendment slip indicating that in several respects the recommendations have become obsolete in the course of the preceding year's work.

Roemer (T.). **Ausgangsmaterial für die Resistenzzüchtung bei Getreide. Ergebnisse 20jähriger Arbeit der Pflanzenzuchtstation Halle a. S.** [Starting material for resistance breeding in cereals. Results of 20 years' work at the Plant Breeding Station of Halle a. S.]—*Z. PflZücht.*, xxiv, pp. 304–332, 1942. [Received August, 1946.]

Many of the studies referred to in the author's survey of 20 years' developments in the breeding of cereals for disease resistance at Halle a. S., Germany, have already been noticed in this *Review*. The following is a summary of the outstanding results. The so-called 'land' varieties, defined as type mixtures arising through purely natural selection, are by no means less susceptible to artificial infection by fungal leaf and ear pathogens than are the élite selections. The former, therefore, should no longer be regarded as 'sound', robust material for breeding purposes, nor is there any reason to discard the reputedly 'sickly, over-bred' élite selections as parental stocks.

Some of the foreign selections resistant to one or more diseases in their countries of origin reacted similarly at Halle to the majority of German physiologic races of the pathogens concerned, whereas others, resistant at home, succumbed to the particular races predominating in Germany. Representatives of the former group constitute very valuable starting material for resistance-breeding operations, and a close watch should therefore be kept on progress in this direction in foreign countries.

Some of the barley forms collected by the German Hindu Kush expedition (*Kühn-Arch.*, liv, pp. 295–368, 1940) were absolutely resistant to leaf and ear diseases, but their many defects in growth habit, incidental to primitive types, necessitate repeated back-crossing to the cultivated parent of the progeny of commercial × primitive crosses to secure an attractive product.

For certain objects interspecific crossing among cereals is indispensable, e.g., *Triticum vulgare* × *T. spelta* or *T. durum* for rust (*Puccinia* spp.) resistance in wheat, *T. vulgare* × *T. persicum* for resistance to mildew (*Erysiphe graminis tritici*) in the same host, and *Avena sativa* × *A. byzantina* for resistance to loose smut (*Ustilago avenae*) in winter oats. Particularly useful as starting material are selections from such interspecific crosses, representing as they do the first stage in breeding for resistance, in which the principal difficulties have already been overcome, and absolute resistance to all races of a given fungus or combined resistance to several diseases is inherent. As the work of selection proceeds, recourse to hybridization with other species and primitive or wild forms should become increasingly rare, and one of the foremost tasks of the scientific institutes should be the production and development of first-stage new combinations for private breeders. Large-

scale efforts to reduce the 10 per cent. toll levied by the chief diseases on the German harvest will then be practicable.

Sibilia (C.). **Alcune razze fisiologiche di Puccinia graminis tritici 'Erikss. et Henn.' nell' Africa Orientale Italiana.** [Some physiological races of *Puccinia graminis tritici* Erikss. & Henn. in Italian East Africa.]—*Boll. Staz. Pat. veg. Roma,* N.S., xx, 2, pp. 115–118, 1940. [Received June, 1946.]

From Aréss wheat grown at Makallè [Abyssinia] and wheat of an undetermined variety grown at Harar [Abyssinia] the author obtained two physiologic races of *Puccinia graminis,* determined as A.O.I. 13 and A.O.I. 3 [*R.A.M.*, xix, p. 395] respectively. These records extend the areas in which these races had previously been found. At the time of writing the three most prevalent races locally were A.O.I. 3, found in Shoa [Abyssinia] and Harar, A.O.I. 13 in Galla, Sidamo, and Eritrea, and A.O.I. 17 in Asmara [Eritrea] and Shoa.

Borzini (G.). **Sull' efficacia anticrittogamica e sul valore agrario di produtti mercurio-furanici. Secondo contributo sperimentale.** [On the fungicidal efficacy and the agricultural value of mercuric-furfuranic compounds. Second experimental contribution.]—*Boll. Staz. Pat. veg. Roma,* N.S., xx, 3, pp. 167–188, 1940. [Received June, 1946.]

Further experiments on the biological effects of mercuric-furfuranic compounds [*R.A.M.*, xix, p. 268] showed that the product F.R.M. obtained from the reaction of furfural and mercuric chloride in equal parts, and used at 5 to 10 per cent. with an inert powder (talcum), is very active as a dry seed treatment for wheat bunt (*Tilletia tritici*) [*T. caries*]. The same can be said of R.F.R., a furfural-mercuric chloride. The proportion of mercury in these two products is only from 1·8 to 3 per cent., but is sufficient to make them as effective in practice as the usual copper oxychloride and calcium materials which contain 16·5 per cent. copper. Preliminary tests indicate that seed treatment with F.R.M. increases wheat yield as much as uspulun does. Products obtained from the reaction between mercuric chloride and furfurilic alcohol, while markedly fungicidal, are distinctly inferior to F.R.M. and R.F.R. as seed treatments. The mercuric-furfuranic products tested showed less fungicidal activity against *T. caries* as soil disinfectants than as seed treatments.

Pal (B. P.) & Mundkur (B. B.). **Studies in Indian cereal smuts. VII. Further studies in varietal resistance of Indian and other Wheats to loose smut.**—*Indian J. agric. Sci.*, xv, 2, pp. 106–108, 1945.

The reactions of 26 Indian and 25 foreign wheat varieties to two races of loose smut [*Ustilago tritici*], L1 and L2, prevalent in India [*R.A.M.*, xxiii, p. 432] are tabulated, and those of 62 new strains of hybrid origin briefly summarized. Nearly 50 per cent. of the varieties tested were resistant to both strains, including the commercially important Imperial Pusa 114, 120, and 165, and Khapli, the Imperial Agricultural Research Institute selections IP 121, 122, 124, 163–3, 163–4, 114–1–8, 120–7, 120–8, and 120–19, and a number of imported varieties, among them three out of four lines of Federation, the rust [*Puccinia graminis*]-resistant Kenya wheats, E114, 148, and 220, and Reliance [ibid., viii, p. 638; xx, p. 560]. Of the new hybrids, 22 were immune from, or very highly resistant to, both races of the smut.

Andrén (F.). **Ett fall av groningsskada på höstsäd.** [A case of germination injury in autumn seed.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1946*, 2, pp. 25–27, 1946.

The effect on the germinability of Ergo wheat seed-grain with moisture contents of 17, 18·5, 21·3, and 23·4 per cent. of treatment with abavit (200 gm. per 100 kg.)

was tested, one lot of each being sown immediately and the other after three weeks' storage [cf. *R.A.M.*, xxv, p. 207]. The fungicide did not contribute to the fall in germinability, but moisture was progressively more deleterious at the higher levels, a heavy drop (20 per cent. and upwards) occurring in samples with the two highest moisture contents. In another series of tests, in which untreated seed-grain of the same variety with moisture contents ranging from 16·6 to 23·1 per cent. was (*a*) sown at once or (*b*) stored for four or eight weeks, the germinability of the former was roughly equal at all moisture contents, whereas that of the latter sank progressively with rising moisture and after two months at the higher concentrations was practically nil, due to heavy contamination with moulds (*Fusarium*, *Penicillium*, *Mucor*, etc.).

EKSTRAND (H.). **Höstsäden och vinterhärdighetsproblemen.** [Autumn cereal seed and the problem of winter-hardiness.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1946*, 1, pp. 15–16; 2, pp. 17–21, 1946.

During the exceptionally cold winters of 1939–40, 1940–1, and 1941–2, the injury suffered by wheat was most severe in the south and central regions of Sweden, where the snow cover was too thin to afford adequate protection to the seed. In the north, on the other hand, damage to this crop tends to predominate in mild, snowy winters, which favour the development of fungi associated with winter injury, such as *Typhula* spp., *Sclerotinia borealis* [*R.A.M.*, xxiii, p. 99], and *Fusarium*.

Winter injury to rye, according to the author's observations, is seldom or never occasioned exclusively by cold. As regards reaction to the snow mould (*F. nivale*) [*Calonectria graminicola*: ibid., xxv, p. 103], rye varieties fall into two groups, one more resistant, comprising, for example, the Finnish Oiva and Toivo, besides Sangaste, Björn, the 'midsummer ryes', and certain 'land' sorts, especially those of Norrland, and the other, relatively susceptible, including Kung, Stål, and selected Vasa II. Generally speaking, wheat is more susceptible than rye to *T.* spp., notably *T. itoana* and *T. borealis*, but as in the case of the snow mould, some rye varieties are more liable than others to infection by these fungi. Like *C. graminicola*, *T.* spp. are more prevalent in the north than in the south of Sweden, and *S. borealis*, which may assume a catastrophic form, not only on wheat and rye but also on pasture grasses, has never been found by the writer farther south than Dalarna and Gästrikland. As far as rye is concerned, the winter-injury fungi constitute the limiting factor in its cultivation in the north, where the regression of the crop is perhaps partly due to the replacement of the old, resistant, but unproductive 'land' varieties in favour of the more modern high-bred types which give prolific yields under favourable conditions but may be unequal to the rigours of the more 'normal' northern winters.

VOSS (J.). **Zur Prüfung der Resistenz von Hafersorten gegen Flugbrand (Ustilago avenae [Persoon] Jensen).** [On the testing of Oat varieties for resistance to loose smut (*Ustilago avenae* [Persoon] Jensen).]—*Z. PflZücht.*, xxiii, pp. 20–46, 4 figs., 1 map, 1941. [Received August, 1946.]

From 1936 to 1938 greenhouse and field tests were carried out on an extensive assortment of oat varieties for their reactions to loose smut (*Ustilago avenae*) by Reed's method [*R.A.M.*, v, p. 27; ix, p. 102; x, p. 652]. Weakly pathogenic strains of the smut predominated in the bulk of the collections (over 100) from different parts of Germany serving as inoculum, so that the cultivation not only of highly, but even of moderately, resistant varieties affords good prospects of practical control. Of the commercial varieties included in these trials, 19·5 per cent. proved to be highly or moderately resistant, among them being Schwarzer Präsident, Rotenburger Schwarz, Anderbecker Gelb, Carstens V (yellow), Endress Franken, Kraffts Rheinischer Gelb, Lischower Früh, and v. Lochows Gelb, while of the new

selections tested in 1937 and 1938, 25 per cent. were highly resistant and 33·3 per cent. moderately so.

RUGGIERI (G.). **Il manifestarsi in natura delle infezioni di 'mal secco' attraverso i 'Verdelli' primaverili.** [The manifestation in nature of infections by 'mal secco' of early forced Lemons.]—*Boll. Staz. Pat. veg. Roma*, N.S., xx, 2, pp. 150–155, 1 col. pl., 1940. [Received June, 1946.]

Repeated observations both in the field and the laboratory have shown that the agent of citrus 'mal secco' disease (*Deuterophoma tracheiphila*) [*R.A.M.*, xxv, p. 439 and next abstracts] can penetrate the zone where the fruits are attached to the peduncle. The fungus then spreads along the fibrovascular bundles of the fruit and peduncle and finally reaches the main branches. The most obvious symptom of such primary infections is a premature, rapid yellowing of the fruit and peduncle, which quickly withers, causing the drying and shedding of the fruit. The fungus was repeatedly isolated from the fibrovascular bundles of the fruit which turn chestnut-colour, from the peduncle, and from the characteristic carrot-yellow wood of the branch bearing the infected fruit at distances up to several decimetres away from the fruit. How *D. tracheiphila* penetrates the fruit has not so far [at the time of writing] been determined. The fruits most commonly attacked are forced lemons (verdelli) which reach commercial maturity between the end of April and the beginning of June.

RUGGIERI (G.). **Relazione sull' attività del 'Posto di Osservazioni sul mal secco degli Agrumi' nel 1940.** [Report on the activity of the 'Observation post for Citrus mal secco' in 1940.]—*Boll. Staz. Pat. veg. Roma*, N.S., xx, 4, pp. 303–329, 10 figs., 1940. [Received June, 1946.]

In this detailed report on studies carried out during 1940 on citrus mal secco disease (*Deuterophoma tracheiphila*) in Italy [see preceding and next abstracts], with special reference to resistant lemon varieties and to citrus varieties that may prove suitable to replace the susceptible bitter orange [*R.A.M.*, xxiii, p. 128] as stock, the author also deals with the form of the disease known to growers as 'mal nero'. His work showed that the presence in the woody tissues of the branches and trunk of large, irregular, brown or pale black, inky spots with orange or carrot-red outer margins [cf. ibid., ix, p. 645] is a well-known symptom of mal secco and is not due to any other disease. From the many isolations from affected material only *D. tracheiphila* was obtained. If the progress of the disease is sometimes 10 to 20 times as rapid as usual ('mal secco fulminante' or 'lightning mal secco'), this is due to spread of the fungus from the roots or stem base upwards (instead of the usual downward progress) and is facilitated by want of cultural care.

RUGGIERI (G.). **Relazione sull' attività del 'Posto di Osservazioni sul mal secco degli Agrumi' nel 1941–42.** [Report on the activity of the 'Observation post for Citrus mal secco' in 1941–42.]—*Boll. Staz. Pat. veg. Roma, N.S.*, xxii, 1, pp. 63–86, 3 pl., 4 figs., 1942. [Received June, 1946.]

Notes are given on the general behaviour of different lemon varieties in various parts of Sicily. Observations on the susceptibility of different stocks to natural infection by mal secco (*Deuterophoma tracheiphila*) [see preceding abstracts] showed that the resistance of the Bouquetier variety of bitter orange among two-year-old plants raised in the nursery was much less than that of adults of the same variety, 68 of 353 seedlings, or 19·2 per cent., developing infection. Seedlings of ordinary bitter orange, however, showed 42·4 per cent. infection (109 of 257), of much more severe intensity. Rough lemon (*Citrus limonia*) was highly susceptible, and of 299 two-year-old seedlings cultivated in the nursery, 140, or 46·8 per cent., became affected. This result was partly due to the marked susceptibility to cold shown by rough

lemon. Of the limes only the Palestine sweet lime (*C. aurantifolia*) appeared to be very satisfactory, not more than 50, or 21·3 per cent., of 239 two-year-old plants becoming affected. The Yuzu orange (*C. junos*) was highly susceptible. The Calamondin orange (*C. mitis*) developed only 20 per cent. infection among 25 two- and four-year-old plants, but did not appear to be well adapted to the local conditions.

In an experiment on the manner of spread of the disease, young Bouquetier bitter oranges were planted all round an affected lemon. For the first few months the bitter oranges appeared to remain healthy, but later they developed infection, nearly all the diseased trees occurring along a line running south-west from the focus of infection, in the direction of the prevailing north-east wind.

PETRI (L.). **Sul creduto originale della 'Phoma limonis' Thümen.** [On the presumed type specimen of '*Phoma limonis*' Thümen.]—*Boll. Staz. Pat. veg. Roma*, N.S., xxi, 2, pp. 157–160, 1 pl., 3 figs., 1941. [Received June, 1946.]

The author reports the results of his examinations of specimens labelled *Phoma limonis* [see preceding abstracts] in Penzig's herbarium, from which he concludes that authentic material of the species is lacking and the species can be based only on Penzig's diagnosis and drawings. It would be possible, therefore, to maintain, as Gassner has done [loc. cit.], that *Deuterophoma tracheiphila* may be a synonym of Thümen's species, but for the fact that *D. tracheiphila* is quite certainly of recent introduction into Sicily and Calabria, and has never been found in central and northern Italy, while *P. limonis* is very uncommon in southern Italy.

FAWCETT (H. S.), KLOTZ (L. J.), WALLACE (J. M.), ZENTMYER (G. A.), ROHRBAUGH (P. W.), & SCHNEIDER (H.). **Quick-decline studies.**—*Citrus Leaves*, xxvi, 4, pp. 6–9, 16, 22, 28, 38–40, 1946. [Abs. in *Chem. Abstr.*, xl, 14, p. 4115, 1946.]

This is a progress report from the Citrus Experiment Station, Riverside, California, on a year's trials and observations in connexion with the quick-decline disease of sweet orange trees grafted on sour orange stock [*R.A.M.*, xxiv, p. 312]. A decrease of starch precedes the death of the roots or top symptoms, progressing from the tips of the smaller roots to the larger main ones. By the time root decay becomes noticeable most of the roots and the sour orange part of the trunk are empty of starch, apparently as the result of the stoppage of food movements from the leaves to the root system. Bacterial or fungal infection of the roots appears to be an indirect or secondary cause of death. No benefit was derived from a number of disinfectant, fertilizer, vitamin, and hormone treatments tested. Twigs from diseased trees usually showed a lower respiration rate than healthy ones. Attempts at the transmission of quick decline by inoculation and grafting gave negative results.

DASTUR (R. H.) & SINGH (S.). **Studies in the periodic partial failures of the Punjab-American Cottons in the Punjab. XIII. Manuring of Cotton.**—*Indian J. agric. Sci.*, xiv, 4, pp. 325–332, 2 figs., 1944.

This contribution to the studies in progress on the tirak disease of Punjab-American cottons in the Punjab [*R.A.M.*, xxiv, p. 313 and next abstract] consists of a tabulated survey of the practical aspects of manuring in relation to the nitrogen status of the soil.

DASTUR (R. H.) & AHAD (A.). **Studies in the periodic partial failures of the Punjab-American Cottons in the Punjab. XIV. Mineral metabolism of normal and tirak-affected plants. XV. Formation of proteins, oil and cellulose in the bolls of normal and tirak-affected plants.**—*Indian J. agric. Sci.*, xv, 2, pp. 63–85, 20 graphs, 1945.

A study of the mineral uptake of normal and tirak-diseased cotton plants [see preceding abstract] on two soil types, (*a*) light, sandy, nitrogen-deficient, and

(*b*) sandy loam with saline subsoil, as reflected in the chemical composition of leaves and bolls at varying stages of development, revealed a shortage of potash at the fruiting period on both soils. The deficiency of the element in the light, sandy soil was an indirect sequel to the insufficiency of nitrogen, the application of which simultaneously increased the assimilation of potash. On the saline soil the potash deficiency was probably associated with a state of physiological drought which impeded the absorption of nutriments.

Protein formation in tirak-diseased cotton bolls ceased from the fifth week of development, instead of being continued until the eighth, as in healthy plants. The decreased rate of protein synthesis was accompanied by a reduction in the dry matter of the bolls. The oil content of diseased bolls was also lower than that of sound ones. The carbohydrate analysis of diseased and healthy bolls revealed no differences, and it is therefore reasonable to conclude that potash deficiency was the primary cause of immaturity in the seeds of the tirak plants. Another feature of the disorder was the low cellulose content of the lint, apparently connected with a decrease in the secondary thickening of the fibre.

Gigante (R.). **La 'mazzarella' del Cotone.** ['Mazzarella' of Cotton.]—*Boll. Staz. Pat. veg. Roma*, N.S., xxi, 4, pp. 332–351, 1 pl., 11 figs., 1941. [Received June, 1946.]

During 1941 the author observed in Sicily a wilt of cotton, referred to by the local growers as 'mazzarella', in which the leaves gradually became flaccid, turned yellow, drooped, and finally withered completely, this stage being followed by the death of the plant. The diseased plants were easily pulled out of the ground, when it was noted that the part just below the collar was considerably swollen and club-shaped ('mazzarella' being Sicilian for a small club). As a rule the affected underground part ended abruptly at this swelling, with no trace of the roots except for a short piece a few cm. long under the collar, which was perpendicular, slightly curved, or elbow-shaped.

Evidently the condition was due to the loss of the root system. No pathogenic organism was found in the affected plants. Wilting was confined almost exclusively to places where the soil was compact, hard, and dry, from which it was concluded that it was due entirely to mechanical factors. Control consists in thorough cultivation before sowing, and destruction of all weeds. Once a fine tilth has been secured the soil should be maintained in this condition.

Gassner (G.). **Die Topallik-Erkrankung der Baumwolle.** [The 'topallik' disease of Cotton.]—*Phytopath. Z.*, xiv, 5, pp. 518–521, 5 figs., 1944. [Received August, 1946.]

The 'topallik' ('lameness') disease of cotton prevalent over wide areas of Turkey from 1936 to 1938, and characterized by the semi-total absence of roots and consequent wilting, was found to be due to excessively high salt concentrations in the soil during the heat of summer; the presence of salt was reflected in the growth of halophytes among the weed flora.

Knight (R. L.). **Breeding Cotton resistant to blackarm disease.**—*Emp. J. exp. Agric.*, xiv, 55, pp. 153–160, 1946.

A preliminary survey of blackarm disease (*Bacterium* [*Xanthomonas*] *malvacearum*), which includes angular leaf spot, bacterial blight, and bacterial boll disease, showed all Egyptian strains to be highly susceptible (though some recovered better than others). In these circumstances it was sought to transfer by back-crossing to the susceptible Sakel genotype the resistance observed in some American Upland (*Gossypium hirsutum*) and Punctatum (*G. hirsutum* var. *punctatum*) cottons

[*R.A.M.*, xxiii, p. 341]. This was successfully accomplished and, as a result, Egyptian strains, fortified with the main genes governing blackarm resistance, are in cultivation. Sakel, the susceptible *G. barbadense* variety, did produce one resistant plant, subsequently ascribed, however, to an out-crossing to *G. hirsutum* and accidental back-crossing in the field. A resistant subdivision has been added to the species by the inclusion of *G. darwinii*, having blackarm resistance, as a variety of *G. barbadense* by J. B. Hutchinson *et al.* ('The Evolution of Gossypium', Oxford University Press, 1946). A further variety in the *G. barbadense* group showing marked resistance, BP 1–1 (Grenadines White Pollen), has been found among the Empire Cotton Growing Corporation's type collection from Trinidad, but has not yet been genetically analysed. All of these will provide material on which further breeding experiments will be based.

Of the resistance factors so far investigated the weak dominant gene B_1 derived from Uganda B31 confers on *barbadense* a resistance slightly greater than that of typical susceptible Upland. Combined with B_2 the resulting resistance is slightly more than with B_2 alone. B_2, the strong dominant gene from Uganda B31, occurs also in some other Upland varieties and in some *punctatum* ones. On the Upland background it gives resistance graded at 6, ranging to 7 under conditions of high humidity, while on *barbadense* cottons it confers grade 7 resistance. In field trials in different localities in the Sudan the Upland variety BAR 7/1 (homozygous for B_2) gave 64 per cent. higher lint yield than a susceptible variety from the same parents and showed much greater 'highest standard counts' (45 and 63 as against 40 and 58). In similar trials BAR 1730L (X1730A to which B_2 has been transferred) [*R.A.M.*, xxiv, p. 449] showed corresponding superiority as regards yield over X1730A, and NT2/41 yielded 665 lb. per acre as against 550 from its counterpart not carrying B_2. Factor B_3 when homozygous confers grade 5·1 to 7·1 resistance on the *barbadense* and Upland types. It is linked to B_2 and the effect of both together is additive; this combination should be used, therefore, wherever blackarm is likely to be severe, with B_1 added to the *barbadense* types intended for these areas.

Resistant types pure-breeding for B_2 are: 513 (ex Punjab Early Strain); MU 8b; U4 Nyasa 5; Uganda Nos. B31, B181, and SP102; NT205/43 (ex Uganda SP20); BAR 7/1 (ex Uganda SP 84); Dharwar American N5 (small sample); BAR 11/2 (XA129 hybrid); BAR 12/1 (Uganda BP 52 hybrid); and BAR 10/2 (Deltapine hybrid). Synthesized types are BAR 13/1 (511 carrying B_2 and B_3) and BAR 7/6 (Uganda SP84 carrying B_3 without B_2).

MUSPRATT (J.). **Experimental infection of the larvae of Anopheles gambiae (Dipt. Culicidae) with a Coelomomyces fungus.**—*Nature, Lond.*, clviii, 4006, p. 202, 1946.

An experimental infection of laboratory-hatched larvae of the malaria vector, *Anopheles gambiae*, with a fungus of the genus *Coelomomyces* [*R.A.M.*, xxiv, p. 504] was undertaken in Johannesburg with the object of exploring the possibility of employing these fungi for the biological control of dangerous mosquitoes.

From 300 to 400 infected *A. gambiae* larvae, charged with thick-walled sporangia, were collected and placed in jars containing water and soil from the infected breeding place at Livingstone, Northern Rhodesia. On the death of the larvae, the soil was allowed to become almost dry, and this, together with about 100 lb. nearly dry clay soil from the same vicinity, was sent to Johannesburg, where it remained in the laboratory throughout the winter. In the summer the main bulk of the soil was heaped in a concrete trough exposed to the sun for three to four hours daily and protected from rain, the soil containing the resting sporangia in the larval remains being scattered over the lower part of the heap. Rainwater was then poured over the soil and newly hatched larvae of *A. gambiae* added. Evaporation to dryness

was allowed to take place every two or three weeks, and the trough to remain dry for three to four days before being refilled and another batch of newly hatched larvae put into it. About 15 of 100 larvae of the second batch became heavily infected, and a few of the later batches, but larval growth was not normal under the conditions at Johannesburg. The author believes that in a suitable climate indefinite infection of *A. gambiae* larvae would be achieved.

MACEDO (A.). **Doenças da Agave.** [*Agave* diseases.]—*Bol. Minist. Agric., Rio de J.*, xxxii, 7, pp. 27–28, 1943. [Received 1945.]

Sisal hemp is stated to be subject to anthracnose (*Colletotrichum agaves*) [*R.A.M.*, xvii, p. 322; and cf. xxv, p. 394], *Dothidella parryi* (Farl.) Theiss., and *Lembosia dendrochili* Lev. in Puerto Rico, *Marssonia* [*Marssonina*] *agaves* [ibid., viii, p. 526] in Colombia, *Septoria megalospora* in Argentina, and *Tubercularia agaves* in Costa Rica. In the State of Parahyba, Brazil, material has been collected of the leaf-spotting fungi, *Pleospora* sp. and *Phyllosticta* sp., while the ordinarily resistant *Agave fourcroides* was attacked by *Didymaria* sp., the foliar depressions induced by which exuded a viscous substance. Anthracnose (*Gloeosporium* [*C.*] *agaves*) has also been reported from Brazil.

ANDRÉN (F.). **Betningsförsök med Lin- och Hampfrö.** [Disinfection experiments with Flax and Hemp seed.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1946*, 1, pp. 10–12, 1946.

In 1945, at the Plant Protection Institute, Stockholm, samples of flax seed infected by fusariosis [*Fusarium lini*] and hemp by *Botrytis* and other fungi were treated with five standard fungicidal dusts at dosages of 200 and 400 gm. and panogen [*R.A.M.*, xxv, p. 207] at 200 and 400 ml. per 100 kg. The average increase in emergence of the treated flax seedlings was 13·6 per cent., for both concentrations, panogen being rather more efficacious than the dusts. The average increase in harvested plants from the standard treatment was 13·3 per cent. (12·3 for the 400 gm. rate and 14·3 for the 200 gm.).

The average increases in emergence of the disinfected hemp seedlings was 17·6 per cent. (22·6 for the 400 gm. rate and 12·8 for the 200 gm.), and the figures were significant for all the treatments except betoxin 61, fusariol 3140b, and abavitneu at the lower dosage. The average increase in harvested plants was 12·4 per cent., and the figures were significant for all the treatments except germisan and abavitneu at 200 gm.

TIMMERMANS (ADRIANA S.). **Het Botrytis-rot der Gladiolen veroorzaakt door Botrytis gladiolorum nov. spec.** [The *Botrytis* rot of *Gladioli* caused by *Botrytis gladiolorum* n. sp.]—*Meded. Lab. Bloembollenonderz. Lisse* 67, 32 pp., 22 figs., 2 graphs, 1941. [German and English summaries. Received 1945.]

Since 1929 a *Gladiolus* corm rot has been observed at the Bulb Research Laboratory, Lisse, Holland, which became increasingly troublesome from 1937 onwards. It is characterized by two types of foliar spots, one oblong, dry, brown, with red margins, and the other small, round, and rust-coloured, the latter also occurring on the stems; water-soaked, oval lesions on the flowers; and decay passing down the vascular bundles of the stem to the heart of the corm, which bears brown spots of irregular size and shape and small ones closely resembling those of dry rot (*Sclerotinia gladioli*) [*R.A.M.*, xiii, p. 461; and cf. xxv, p. 394], probably a frequent concomitant of the pathogen. All the lesions yielded in pure culture on prune agar a species of *Botrytis* to which the name of *B. gladiolorum* n. sp. is assigned [without a Latin diagnosis]. Its hyaline, oval to ovate or quasi-spherical conidia, borne on pale grey-brown conidiophores, measure 10 to 22 by 8 to 13 (average 15 by 10) μ,

and are thus distinct from those of *B. gladioli* Kleb. [ibid., x, p. 274], which measures 8 to 15 by 3 to 6 (10·4 by 4·7) μ and are produced from dark brown conidiophores. The minimum, optimum, and maximum temperatures for the growth of the fungus are below 3°, 20° to 22·5°, and 30° C., respectively, and the optimum and maximum pH 5 to 5·5 and 7, respectively.

The progressively heavy damage caused by the disease of recent years is attributed to the extreme susceptibility of the leading new varieties; the inability of some growers to provide the necessary ventilation and heating in their store-rooms; and the prevailing weather conditions, which have been conducive to the development of infection.

Experiments have shown that the incidence of the rot is lower on corms lifted early (24th September to 4th October) than on those left in the ground until mid-October. Storage at a temperature of 25·5° or 30° promotes rapid drying of the corms and precludes any appreciable spread of infection, but those kept for a month in a cold, damp place undergo extensive decay, which may be mitigated to some extent by pulling off the stems immediately after lifting, rather than cutting them off at some distance from the corm.

LIMBER (D. P.). **A note on the distribution of black rot of Orchids.**—*Plant Dis. Reptr*, xxx, 3, p. 89, 1946. [Mimeographed.]

Three of the 13 interceptions of orchids on account of black rot (a disease attributed to various Pythiaceae) made by the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture (unpublished records), were associated with a Phycomycete with subspherical sporangia smaller than those of the more common Pythiaceous fungus with ovate, papillate sporangia found in the other material examined. The three specimens in question were hothouse-grown species of *Cattleya* originating in England, and a fourth from the same country may also have been infected by the fungus with small sporangia, a point that cannot now be ascertained. Seven of the remaining nine wild orchids came from Venezuela, six *Cattleya* and one (?) *Epidendrum*, and one each from Colombia (*Cattleya*) and Cuba (*Oncidium*).

V. Rossetti, describing a black rot of orchids in São Paulo, Brazil [*R.A.M.*, xxiii, p. 64, where the place of origin is given in error as Buenos Aires], states that the same or a similar disease of *Cattleya* and *Vanda* has been reported from Puerto Rico, and of *Stanhopea saccata* from an unnamed locality. Saccardo (*Syll. Fung.*, xii, p. 651, 1897) records *Pythium debaryanum* on *S. saccata* in Germany.

NIEUWDORP (W. A.). **De bladrandchlorose van Rhododendron catawbiense 'grandiflorum'.** [The leaf-margin chlorosis of *Rhododendron catawbiense* 'grandiflorum'.]—Thesis, Wageningen Agricultural College, 180 pp., 41 figs. (11 col.), 3 graphs, 1945. [English, German, and French summaries.]

Chlorosis of the leaf margins is the most prominent symptom of a pathological condition of the economically very important *Rhododendron catawbiense* [var.] 'grandiflorum' in the Boskoop district of Holland. Towards the beginning of July a yellowish-vermilion-green discoloration, densely speckled in transmitted light, becomes perceptible along the margins and between the veins of the first order to about half-way to the midrib. In the autumn, when the leaves are fully developed, the colour contrasts are more accentuated, the affected area by this time having assumed a cadmium-yellow tint. A relatively inconspicuous foliar mottling is another feature of the disorder which often co-exists with the marginal chlorosis. The average chlorophyll content of chlorotic leaves was only 44 per cent. of that of the sound foliage; it tended to be lower in the marbled specimens than in those with marginal chlorosis. Owing to the defective structure of the root hairs, the root-balls of diseased plants are of a very loose texture and easily disintegrate.

The trouble appears to originate in an unduly high proportion of calcium in the soil and a deficiency of nitrogen. Thus, the degree of acidity in the soils giving rise to the *Rhododendron* chlorosis averaged less than one-eighth of that prevailing in ground supporting normal growth, and the nitrogen content of chlorotic foliage ranged from 79·3 to 126·3 mMol per 100 gm. dry material compared with 128·3 to 215 mMol in healthy leaves. A promising line of approach to the problem of control consists in the application of sulphur to the soil at a rate not exceeding 13 lb. per 17 sq. yds.

LIHNELL (D.). **Azaleor och Applen.** [Azaleas and Apples.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1946*, 1, pp. 7–10, 1 fig., 1946.

Experimental evidence is adduced in confirmation of the view already expressed that the leaf and twig blight of azaleas [*Rhododendron*] imported into Sweden from Belgium is a result of carbon dioxide poisoning during transport [*R.A.M.*, xxii, p. 482], apples in the same hold having been the source of the toxic emanations.

COHEN (C.). **A note on Hollyhock rust (Puccinia malvacearum Mont.) in South Africa.**—*S. Afr. J. Sci.*, xlii, pp. 137–138, 1946.

Moisture appears to be an essential condition for the germination of the teleutospores of hollyhock rust (*Puccinia malvacearum*), which rapidly die when the leaves are allowed to dry. The rust is capable of overwintering by means of the more or less dormant sori on the leaves left at the base of the plant. Germination may occur from early spring to midwinter and be followed by fresh infections under suitable conditions. In the laboratory the spores remained alive for 50 days in a humid atmosphere at a low temperature.

KAREL (G.). **Über den Rost von Vinca herbacea.** [On the rust of *Vinca herbacea.*]—*Phytopath. Z.*, xiv, 5, pp. 450–454, 4 figs., 1 graph, 1944. [Received August, 1946.]

In his study on the nomenclature of two *Vinca* rusts, *Puccinia vincae* [*R.A.M.*, xix, p. 599] on *V. major* and *P. cribrata* on *V. minor* (*Phytopath. Z.*, xii, pp. 229–231, 1939), E. Gäumann mentions a third species on *V. herbacea* from Kharkov, Ukraine, the specific identity of which he was unable to determine on the basis of the available material. The rust in question is annually observed at the Ankara (Turkey) Plant Protection Institute, causing foliar stunting and chlorosis and an upward curvature of the shoots, while the normally opposite leaves are arranged in verticils of three. The dimensions of the uredo- and teleutospores agree in essentials with those of *P. vincae* and the undetermined species on *V. herbacea* from Kharkov, but the teleutospores of the Ankara specimens are slightly longer than those given by Gäumann ($39{\cdot}5 \pm 3{\cdot}07$ as compared with $36{\cdot}9 \pm 2{\cdot}59\ \mu$), which would appear to justify the erection of a new form for the latter [see next abstract].

GASSNER (G.). **Über Puccinia anatolica n. spec. auf Vinca herbacea W. et K.** [On *Puccinia anatolica* n. sp. on *Vinca herbacea* W. & K.]—*Phytopath. Z.*, xiv, 5, pp. 455–474, 7 figs., 6 graphs, 1944. [Received August, 1946.]

An intensive study of the *Puccinia* described by Karel from Ankara on *Vinca herbacea* [see preceding abstract] revealed differences from *P. vincae* of sufficient magnitude to justify the erection of a new species, *P. anatolica*. The rust forms two types of uredo- and teleutospores under divergent climatic and topographical conditions. The large uredospores measure 27 to 40 (mean 33·8) by 21·1 μ, and the small ones 24 to 35 (30·3) by 24·2 μ. The large teleutospores measure 36 to 54 (42·9) by 19·25 (23·2) μ, and the small ones 31 to 42 (37·6) by 23 to 29 (25·1) μ. The rust overwinters in its host in the mycelial stage, and among the symptoms of

infection are the production by the rhizomes of fascicles of up to 15 shoots and partial suppression of flowering.

HADORN (C.). **Marmorierte Panaschüre oder Gelbfleckigkeit der Blätter von Saintpaulia und verwandter Arten.** [Mottled variegation or yellow spotting of the leaves of *Saintpaulia* and related species.]—*ForschErgebn. Gartenb., 1942*, 1, pp. 13–15, 1 fig., 1 diag., 1942. [Received 1945.]

Saintpaulia and other members of the Gesneriaceae are subject in Switzerland to a foliar variegation consisting of greenish-yellow to yellowish-white, sharply defined spots of very variable size and assuming the most bizarre shapes, the same leaf bearing a variety of lines and spots. The disappearance of chlorophyll from the palisade tissues to which the chlorosis is due is attributed to excessive solar irradiation and abrupt temperature fluctuations, notably in the spring and autumn. Control should be based on the protection of the plants from intensive, direct sunlight and the maintenance of uniform temperatures in the greenhouse.

ISAAC (I.). **Verticillium wilt of Sainfoin.**—*Ann. appl. Biol.*, xxxiii, 1, pp. 28–34, 1 pl., 3 figs., 1946.

This study is based on the isolation by F. T. Brooks in 1940 of a microsclerotia-forming species of *Verticillium*, *V. dahliae*, from wilting sainfoin [*Onobrychis sativa*] plants at the Plant Breeding Institute, Cambridge. It appears to be the first record of the disease in Britain [cf. *R.A.M.*, xxv, p. 166] and to have been restricted to a plot at the Institute and two others in the neighbourhood, no wilt having yet been seen on any of the numerous sainfoin leys in East Anglia.

The fungus is shown as able to penetrate sainfoin seedlings through unwounded roots. The infection causes the outer, and subsequently the inner, leaves to fold upward along the midrib and to become pale green, turning yellow and finally brown. Necrotic collapse, associated with loss of cell turgor, marks the most rapid progress of the disease during the hot months of June, July, and August. Plants show internal dark brown discoloration of the wood characteristic of *Verticillium* hadromycosis; gum inclusions are often present but no tyloses were observed.

Inoculations of both common and giant sainfoin, grown from seed in uninfected soil, by the insertion of a fragment of culture of *V. dahliae* into cuts in the main root just below ground-level and in the stems and inoculations of the soil resulted in wilting after 6 to 12 weeks while the controls remained healthy. *V. dahliae* was reisolated from all the wilted plants. After two days' exposure to a spore suspension seedlings were penetrated in the root cap region, and after nine days they were deeply penetrated at all points of contact.

During experiments for the isolation of *Verticillium* from the naturally infected soil of the Cambridge site, *V. nigrescens* was recovered in every month of the year, but *V. dahliae* only during June, July, and August, and even in these months only from soil within 1 ft. of diseased plants.

V. dahliae, *V. albo-atrum*, and *V. nigrescens* retained their viability for three years on test-tube slants of Dox's or prune-extract agar. With cultures on sterilized wheat grains of these three species and the hyaline variants of *V. dahliae* and *V. albo-atrum*, respectively, maximum viability was found to be for *V. dahliae* 7 to 8 weeks, for *V. albo-atrum* and *V. nigrescens* 12, and for both hyaline variants six months. Tests of the viability of *Verticillium* in unsterilized and partially sterilized potting soil given different amounts of water showed that the fungus could be isolated from all up to 15 weeks but not from waterlogged soils after the same time, while after 22 weeks all attempts at isolation failed for all treatments. These and other experiments suggested that *V. dahliae* is present in the soil in two forms, the microsclerotial form which may persist in the soil for at least five months and the

hyaline variant which is equally virulent but persists for a short time only. Heavy liming caused no reduction in the susceptibility of sainfoin plants to wilt.

COHEN (C.). **A note on the biology of Ustilago cynodontis (P. Henn.) and Ustilago bromivora (Tul.), F. de Waldh.**—*S. Afr. J. Sci.*, xlii, pp. 135–136, 1946.

The writer observed a distinct difference, in respect of germination processes, between *Ustilago cynodontis* from *Cynodon dactylon* [*R.A.M.*, xix, p. 120; xx, p. 382; xxiii, pp. 360, 501] and *U. bromivora* [ibid., xxii, p. 361] on *Bromus unioloides* [ibid., xxi, p. 493], the former germinating readily either immediately on collection or after intervals of storage up to more than 15 months, while the latter failed to do so at all, either spontaneously or in response to various stimulatory treatments.

In the Transvaal, field plants of *C. dactylon* show the first traces of smut about the beginning of October, and thenceforth further infections are likely to occur until the end of the summer. On the other hand, *U. bromivora* tends to develop later on *B. unioloides*, appearing first towards the end of October, and, in some seasons at any rate, producing few sori until later. A correlation may perhaps be discerned between the outdoor behaviour of the two smuts and their divergent modes of germination.

BINGEFORS (S.). **Några iakttagelser beträffande två svampsjukdomar på Lusern.** [Some observations concerning two fungous diseases of Lucerne.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1946*, 2, pp. 30–31, 1 fig., 1946.

Ascochyta medicaginis [*Stagonospora meliloti*], an uncommon parasite of lucerne [*R.A.M.*, xviii, p. 320] in Sweden, caused considerable damage in 1945 in a crop laid down near Upsala for experiments on the best time for harvesting. At the first harvest, in June, the foliage was in excellent condition; at the second, in late July, incipient infection by *Pseudopeziza medicaginis* was apparent; at the third this pathogen assumed a virulent form and *S. meliloti* was also in evidence; while at the fourth, in early October, the latter was destructive and the former had regressed to insignificant proportions. Early harvesting as a precaution against *S. meliloti* would thus appear to be indicated in warm, humid seasons.

WARD (K. M.). **Deficiency disorders in deciduous fruits.**—*Qd agric. J.*, lxii, 4, pp. 215–226, 12 pl., 1946.

Deficiency disorders continue to appear in almost all kinds of deciduous fruits in the Stanthorpe district of Queensland.

Little leaf of apples, pears, and stone fruits and probably also of grape vines [*R.A.M.*, xxiv, p. 421] occurs on all granitic soils [see next abstract]. For control, winter spraying for two consecutive years with zinc sulphate at a concentration of 20 lb. to 80 gals. water (or 40 to 80 lb. in acute cases for the first spraying) is followed in alternate years by the weaker spray in order to retain an adequate balance of zinc in the trees. Pruning should be done beforehand or delayed for at least two weeks to avoid spray injury.

Wither-tip is liable to affect all varieties of apples at various ages in the Stanthorpe district, where it is rather widespread. This disorder has occasionally occurred on pear trees, but has not yet been noted on stone fruit trees although it resembles exanthema of stone fruits attributed to copper deficiency [ibid., xv, p. 730]. It affects all apple trees on newly broken land, whether young or old. The primary symptoms in both apples and pears appear in late spring, the new apical growth being arrested and becoming unhealthy. Brown areas appear on half-grown leaves and on older ones near each tip, quickly followed by necrosis of the tissues in the affected parts, leaving large, irregularly shaped, brown blotches. In the Delicious variety, however, they begin as numerous small red patches,

which soon die, leaving behind blotches about ⅛ in. in diameter, recalling shot hole in stone fruit leaves. The shoot becomes defoliated for upwards of 9 in. from the tip, wilts, and bends over characteristically to one side. If this stage is reached early in the season, new twigs grow up from live buds below, but become affected later. Unlike little leaf, this disease is not confined to the leaders. The general effect is marked suppression of growth and loss of vigour. A superficial roughening or scurfiness of the bark is a typical symptom and may cover nearly the whole tree, except for first-year shoots. The fine cracks deepen and cause the roughness to become coarse and flaky, if treatment is not given. A Bordeaux spray (4–4–40) in late spring will confer benefit lasting several years, but preferable treatment for both bearing and non-bearing trees is a soil application of ¼ to ½ lb. per tree of fine copper sulphate crystals, scattered evenly over a large area round each tree and ploughed in late in the winter so that it becomes available by the following spring and summer. This treatment has ensured freedom from wither-tip for a period of five years.

Damage due to boron deficiencies [ibid., xxiii, p. 334] such as internal cork, corky core, superficial cork or drought spot, and measles [ibid., xvii, p. 400] in apples, and 'hen and chickens' in grapes [ibid., xxiii, p. 206], may be controlled by a foliar spray (0·5 per cent.) or soil applications of ¼ to ½ lb. borax per tree, the borax being mixed well with several times its own volume of dry sand or fine soil to secure a wide and even distribution round the tree, which is essential in order to avoid toxic effects. Suitable boron treatments will remain effective for several years. Borax at the rate of 2 oz. per vine is recommended where the 'hen-and-chickens' disorder is present in vineyards, widely scattered and subsequently ploughed in during late winter or early spring. Spray treatment (0·5 per cent.) before blossoming should be repeated the following season to avoid a recurrence of the trouble.

Combined sprays including minor elements are not considered feasible in most cases, but zinc sulphate control for little leaf may be used with winter lime-sulphur. Winter oil sprays should be delayed for a month after applying the zinc sulphate. Borax solution and standard lead arsenate have been combined without injury to the trees.

McWhorter (O. T.). **Zinc-coated nails check 'little leaf'.**—*Bett. Fruit*, xxxix, 10, p. 11, 1945.

The use of zinc-coated nails for checking 'little leaf' [see preceding abstract] in cherry, apricot, peach, pear, walnut, and prune trees is reported as having been successful in eastern Oregon; spraying, however, is recommended for small trees in view of damage to their trunks from the insertion of nails. The nails should be placed 1 in. apart up and down the tree and ½ in. apart transversely in a spiral. From 15 to 20 nails should suffice; their heads should be removed, and they should be driven only half their length into the tree, to avoid damage to the bark. Large trees may require 30 to 40 nails. The curative results usually begin to appear six to eight months after placing and are claimed to be lasting. Foliage sprays confer improvement within 30 days but must be renewed annually.

Florenzano (G.). **Italy. Occurrence and first observations on the production of the perfect stage of Venturia pirina and V. inaequalis in the country.**—*Int. Bull. Pl. Prot.*, xvii, 9, pp. 120M–125M, 6 figs., 1943. [Received July, 1946.]

After stating that attacks of pear and apple scab (*Venturia pirina* and *V. inaequalis*, respectively) are becoming progressively more frequent and threatening in Italy, the author gives a detailed description of these two perfect states, found in late December, 1942, on material collected near Florence in November, and in March, 1943, on leaves from various parts of Italy; ripe perithecia of both species were abundant in the latter collections. With *V. inaequalis*, the ripe peri-

thecia were mostly found on the upper surface of the leaf, and were rather larger than usual, measuring approximately 150 to 160 μ in diameter.

SMOCK (R. M.) & SOUTHWICK (F. W.). **Studies on storage scald of Apples.**—*Bull. Cornell agric. Exp. Sta.* 813, 39 pp., 1 fig., 1 graph, 1 diag., 1944. [Received July, 1946.]

In continuation of their earlier work on storage scald of apples [*R.A.M.*, xxi, pp. 82, 209, 457], the authors present a full account of further studies on the disease. Rhode Island Greening, North-Western Greening, and Cortland are cited as highly susceptible varieties, Rome Beauty, Delicious, Grimes Golden, Stayman Winesap, Wealthy, and Baldwin as frequently affected, and McIntosh and Northern Spy as relatively resistant.

The following measures for control showed varying results: shading branches of Rhode Island Greening and McIntosh trees with cheesecloth during growth usually reduced the incidence of scald in storage; defoliation early in growth seemed to reduce it in many cases; the use of oiled paper proved the best pre-storage treatment, but did not ensure control, while wax emulsion [loc. cit.] proved equally satisfactory on later picked fruit and is suggested for commercial testing; coating the fruit with commercial mineral oil gave variable results with sometimes no effect; nitrogen fertilizer treatments reduced scald little in Rhode Island Greening, but delayed storage may reduce it in this variety, although some shrivelling and more bitter pit are likely. In relative humidity studies scald was worse where there was free water in the experimental chambers, but shrivelled fruits did not as a rule scald badly. A fair correlation between the production of total volatile materials and scald incidence was observed, the disorder proving somewhat severe in McIntosh apples exhibiting high volatile production, which was observed to increase the extent and severity of scald on Cortlands and Greenings. Vapours of ripe fruits of these last two varieties slightly damaged mature fruits in storage, but less than those of McIntosh. A limited commercial trial of activated carbon as an air-conditioning agent is recommended for the removal of scald gases in storage.

GIGANTE (R.). **Una laciniatura delle foglie di Pesco causata dal freddo.** [Laciniation of Peach leaves caused by cold.]—*Boll. Staz. Pat. veg. Roma*, N.S., xx, 2, pp. 125–136, 1 pl., 7 figs., 1940. [Received June, 1946.]

The author describes a condition of peach leaves from Trieste characterized by sinuosity of the margins and the presence of circular, elliptical, or irregular holes in the blade. The slashed margins were bounded by a cork layer. The midrib showed necrosis along the whole or part of its length, the necrotic parts being separated from the healthy by corky tissue. Sections along the midrib showed circular or elliptical lacunae filled with gum in the woody tissue. The twigs bearing the affected leaves showed damage by preceding late cold, and the condition of the leaves is attributed to the same cause.

BIRAGHI (A.). **Sulla presenza di cordoni endocellulari in Mandorli danneggiati da freddo.** [On the presence of endocellular cordons in Almonds injured by cold.] —*Boll. Staz. Pat. veg. Roma*, N.S., xxi, 2, pp. 101–116, 7 figs., 1941. [Received June, 1946.]

An account is given of a wilt of almond trees growing near Palermo which was ascertained to be due to death of the cambium following repeated cold spells. The trees had suffered slightly from the effects of cold during the two previous seasons, and while some of the branches showed only the usual effects of such conditions, others were observed to contain endocellular cordons [cf. *R.A.M.*, viii, p. 546; xvii, p. 95, *et passim*]. Discussing the possible significance of these bodies in various hosts, in the light of his own observations and those of other workers, the author

puts forward the view that they result from disturbances due to environmental factors.

Young (H. H.). **A method of control of the 'gummosis' disease in the Apricot tree.**—*Aust. J. Sci.*, viii, 2–3, pp. 85–86, 4 figs., 1945.

The following method has given satisfactory control of apricot gummosis in South Australia [*R.A.M.*, xxiv, p. 445]: excision of every patch of infection until the fresh wood is reached; painting of the wound, all pruning cuts, and the pruning saw with 1 per cent. gentian violet solution, and sealing with a lead preparation (paint or bitumen); and spraying with Bordeaux mixture by the standard schedule.

Benlloch (M.). **Clave para reconocer las plagas y enfermedades del Olivo por sus síntomas externos.** [Key for the recognition of Olive pests and diseases by their external symptoms.]—*Publ. Estac. Fitopat. agríc. Madr.* 16, 14 pp., 23 pl., 1945.

The following pathogens affecting the olive in Spain [*R.A.M.*, xxv, p. 171] are included in this useful, illustrated key for their identification by means of external symptoms: *Cycloconium oleaginum, Antennaria elaeophila* [ibid., xx, p. 504], *Stictis panizzei, Bacterium* [*Pseudomonas*] *savastanoi, Macrophoma dalmatica, Gloeosporium olivarum, Rosellinia necatrix, Armillaria mellea,* and *Fomes fulvus* var. *oleae.*

Gigante (R.). **Un grave attacco di 'rogna' sui frutti di Olivo.** [A serious attack of 'knot' on Olive fruits.]—*Boll. Staz. Pat. veg. Roma,* N.S., xx, 3, pp. 161–166, 1 pl., 5 figs., 1940. [Received June, 1946.]

Olive branches were received by the author which, together with the fruit peduncles, were severely attacked by knot disease (*Pseudomonas savastanoi*) [*R.A.M.*, xix, p. 581 and preceding abstract]. The fruits had sustained even more serious injury. Their development had become arrested, and as a result of the presence of extensive tumours, mostly localized in the basal parts, they were deformed. The fruit tumours in all cases extended to a certain depth in the mesocarp and in many instances reached the stone, though only in one example was the stone affected, the tumour being of very complex nature, beginning in the peduncle and spreading to the mesocarp and stone. The bacterium can attack the stone when the fruit is still in an early stage of development. Externally, the tumours were covered with several cork layers which became lacerated as the tumour enlarged.

Pesante (A.). **Sopra due micosi dei rametti d'Olivo.** [On two mycoses of Olive branches.]—*Boll. Staz. Pat. veg. Roma,* N.S., xx, 4, pp. 300–302, 1940. [Received June, 1946.]

In the spring of 1939, in the coastal area of Messina, the young branches of olive trees (mostly on only one side of the crown) partially withered and hung down. The disease, present apparently for some years, had grown worse recently. The wilt started at the apex and spread towards the trunk; the diseased part was sharply marked off from the healthy. From affected material from several different localities the author constantly isolated a fungus belonging to the Sphaeropsidales, which in culture formed sub-immersed, sometimes confluent, thick-walled, round pycnidia measuring 120 to 370 μ in diameter, with bacillary, hyaline spores, 3·2 to 4 by under 1 μ, borne on short, hyaline conidiophores. Inoculations of healthy young olive trees from cultures gave positive results in three months, wilt extending for some cm. from the site of inoculation and the fungus being re-isolated from the affected parts.

Olive trees in Cosenza also showed a defoliation of the young branches, which assumed a characteristic reddish colour; this became even more conspicuous when the bark, which was readily detachable, was removed. The transition from the diseased to the healthy part was gradual. Hyphae were present in the wood vessels only, while gum was sometimes noted in the lumina of the elements of the outer xylem. The condition appeared to be a form of tracheomycosis. Various fungi were isolated from affected material, two Sphaeropsidales by reason of their constant presence apparently being responsible for the condition. In culture, one gave isolated, thick-walled, round pycnidia, 0·5 to 1·2 mm. in diameter, branched, verticillate conidiophores, and allantoid, hyaline conidia 5 to 6 by 1 to 1·2 μ; the other gave a pale red mycelium with needle-shaped dendroid crystals, thick-walled pycnidia 0·4 to 1·2 mm. in diameter, and allantoid, hyaline conidia 6·5 to 7 by 1·2 to 1·5 μ.

McKnight (T.). **Water blister disease of Pineapples.**—*Qd agric. J.*, lxii, 5, p. 278, 1946.

Serious wastage of pineapple fruit in southern Queensland caused by water blister disease [*Ceratostomella paradoxa*] has led the author to renew his recommendations made in 1941 [*R.A.M.*, xx, p. 374] for the control of the disease. Fairly high temperatures and unusually abundant moisture in February and March this year enabled *C. paradoxa* to enter and rapidly rot discarded material, prolific sporulation occurring on the surface.

Ruyle (E. H.), Pearce (W. E.), & Hays (G. L.). **Prevention of mold in kettled Blueberries in No. 10 cans.**—*Food Res.*, xi, 3, pp. 274–279, 1946.

The presence of spores of the unusually heat-resistant *Penicillium* described by Williams *et al.* [*R.A.M.*, xxii, p. 258] on blueberries [*Vaccinium*] grown in many parts of the United States indicates that contamination of the raw product is prevalent. Considerable reduction in infection of the canned product can be secured by thorough washing of the fruit and cleansing of inspection belts and plant equipment, while visible mould growth is preventable by elimination of oxygen from the can through the substitution of nitrogen or other inert gas for the air in the headspace. A method must also be provided for the exclusion of air mechanically entrapped in the berries or for allowing it to escape before sealing the can with inert gas in the headspace. Comparable mould growth occurred in both plain and enamelled cans and was not noticeably affected by the different rates of oxygen disappearance in the two types.

Whelton (Rita), Phaff (H. J.), Mrak (E. M.), & Fisher (C. D.). **Control of microbiological food spoilage by fumigation with epoxides.**—*Food Industr.*, xviii, 1, pp. 91–93; 2, pp. 84–86, 228, 230, 3 figs., 1 graph, 1946.

The use of the epoxides ethylene oxide and propylene oxide, in which an oxygen atom is linked to two connecting carbon atoms in the same chain, as a method of combating microbiological spoilage of unsulphured fruits (prunes and Black Mission figs [*R.A.M.*, xxii, p. 143] in this series of tests) of high moisture content (25 to 26 per cent. in the former case and over 30 per cent. in the latter) was investigated at the Division of Food Technology, University of California.

Figs packed in 12-oz. cartons containing a mixture of ethylene oxide and isopropyl formate were free from moulding or fermentation after six or seven months' storage in large-scale experimental runs in commercial plants, as little as 0·5 c.c. 10 per cent. ethylene oxide per package sufficing to prevent spoilage. Propylene oxide also gave promising results.

The nature of the residues left by epoxide fumigants and their possible toxicity

is discussed. The likelihood of any untoward effects on man from this source is considered to be very remote. A few suggestions are made for other applications of fumigants in general to the problem of microbiological spoilage.

DEAN (F. P.). **Injector helps in mixing sprays.**—*Bett. Fruit*, xxxix, 10, p. 13, 3 figs., 1945.

A description is given of a small injector for mixing sprays. It is designed from ordinary pipe fittings. The body is a 1 in. tee with a $\frac{3}{4}$ in. side opening, and is fitted at one end with a 1 by $\frac{3}{4}$ in. bushing and inside this a $\frac{3}{4}$ by $\frac{1}{2}$ in. bushing. A $\frac{1}{2}$ in. plug, with a small hole in the centre, is screwed into the smaller bushing, and should extend at least to the mid-point of the tee. A jet is thus formed, the aperture of which should be varied according to the capacity of the spray pump. An $\frac{1}{8}$ in. opening is suitable to a 20 gals. per minute capacity pump. The injector is connected by high-pressure spray hose to the water pump while the side opening of the tee, fitted with garden hose, receives the concentrated spray materials from the container in which they have been mixed. The opposite end of the tee is fitted with an 18 in. length of 1 in. piping which leads the mixture into the spray tank.

MALQUORI (A.) & BORZINI (G.). **Rame-Bentonite come anticrittogamico.** [Copper-bentonite as a fungicide.]—*Boll. Staz. Pat. veg. Roma*, N.S., xxi, 3, pp. 185–220, 1 fig., 3 graphs, 1941. [Received June, 1946.]

Laboratory studies on fungicides containing reduced quantities of copper prepared with bentonite and copper salts showed that in these products active copper is easily liberated to exert its toxic action against fungal spores, while its activity is naturally potentialized by the colloidal nature of the bentonitic clay.

The evidence demonstrated that ionic copper is of greater fungicidal efficacy than molecular copper. Bentonite copper is equally suitable for sprays made with solutions of inorganic or organic salts, in which the soluble copper is, respectively, in a simple and complex ionic state. The active element contained in the spray residues is more important fungicidally than that contained in the liquid phase of the spray. Confirmation was obtained of the fungicidal action of insoluble copper products due to the solution of the copper by secretions from spores. Cupric sprays containing organic oxyacids and their salts are of greater fungicidal efficacy than those containing inorganic compounds. The organic ions show a stronger tendency to render soluble insoluble copper compounds by forming complex cupro-organic ions which, in association with the copper-bentonite, mobilize both the exchangeable copper and that of the basic salt. Further, the drying of cupro-organic sprays containing copper-bentonite does not result in the copper becoming markedly insoluble.

Combination of organic compounds with copper salts in fungicides would appear to be effective indirectly by facilitating the penetration of the copper into the plant tissues. In copper-bentonite sprays ammonium tartrate was found to be at least as fungicidal as citric acid. The incorporation of colloidal argillaceous materials, such as bentonite, improved fungicides by increasing their adhesiveness.

These results are considered fully to justify the use of copper-bentonite sprays in field trials against vine *Peronospora* [*Plasmopara viticola*].

RIVERA (V.), SEMPIO (C.), & SHKJEZI (A.). **The fungicidal efficiency of urine and the doses to be employed in treatments.**—*Int. Bull. Pl. Prot.*, xviii, 1–2, pp. 1M–7M, 1944. [Received July, 1946.]

The results of preliminary experiments on the fungicidal effects of animal urine showed that inhibition of conidial germination of *Erysiphe graminis* was obtained with urine used 24 hours after being taken and at a dilution of not more than 1 : 2. The addition of calcium (lime) and sulphuric acid together slightly increased the

depressive effects of the diluted urine. The uredospores of *Uromyces appendiculatus* were more susceptible, no germination occurring in dilutions up to 1 : 8, fresh urine appearing less effective than that fermented for seven days. For conidia of *Bremia lactucae* a concentration of 1 : 1 proved inhibitive and one of 1 : 4 (using urine more than one day old) highly unfavourable to germination. Tests on both potted and field vines indicated that dilutions of urine exceeding 1 : 2 do not seriously damage the vegetation; it is hoped to conduct tests on *Plasmopara viticola* later.

HARTSUIJKER (K.). **Het wetenschappelijk onderzoek van fungicieden.** [The scientific study of fungicides.]—Thesis, Univ. Amsterdam, 143 pp., 1940. [English summary. Received 1946.]

Following a review of the historical development of plant-disease control, especially by means of fungicides, the author describes his laboratory experiments, conducted mostly by McCallan's method [*R.A.M.*, ix, p. 730], to determine the toxicity to the spores of *Venturia inaequalis, V. pirina, Phytophthora infestans, Cladosporium fulvum, Septoria apii-graveolentis, Ascochyta pisi, Helminthosporium sativum,* and *Botrytis cinerea* of (1) hydrated copper sulphate, mercuric chloride, cadmium chloride, hydrated nickel sulphate, and hydrated zinc sulphate; (2) three polysulphides (calcium, ammonium, and barium), calcium monosulphide, and a colloidal bentonite sulphur; and (3) calcium and ammonium polysulphides in combination with powdered lead arsenate and the adjuvants, lime and iron (ferrous) sulphate.

Both copper sulphate and mercuric chloride exerted a powerful fungistatic action on the spore germination of the test organisms, but the latter was the more efficient fungicide of the two. In the case of copper sulphate the threshold of toxicity for *A. pisi, B. cinerea, H. sativum, V. inaequalis, V. pirina,* and *P. infestans* lay between 0·0001 and 0·00001 per cent. copper, *B. cinerea* and *H. sativum* being the most resistant; the limits for *C. fulvum* and *S. apii-graveolentis* were above 0·00001 and between 0·00005 and 0·000001 per cent., respectively. For mercuric chloride the threshold of toxicity in respect of *A. pisi, B. cinerea, C. fulvum, V. inaequalis,* and *S. apii-graveolentis* lay between 0·0001 and 0·00001 per cent. mercury, and the values for *V. pirina* and *H. sativum* were little higher, whereas *P. infestans* was more sensitive, the threshold for indirect germination lying between 0·00001 and 0·000001 per cent., while direct germination commenced at 0·00005 per cent. The toxicity of cadmium chloride generally fell below that of copper sulphate and never exceeded it. There were marked discrepancies in the data relating to nickel sulphate, which was the most toxic of all the salts to *B. cinerea* and also exercised a very adverse influence on indirect germination in *P. infestans*. The lower concentrations of nickel sulphate, for some unexplained reason, were more lethal than the higher ones, and a similar relationship was observed with copper sulphate and *B. cinerea.* The toxicity of zinc sulphate to most of the fungi used in the tests was negligible. It did, however, exert a strong preventive effect on indirect germination in *P. infestans,* approximately equal to that of copper or cadmium sulphate.

It is apparent from these results that none of the metallic salts examined can replace copper sulphate as a fungicide, since the equally or more effective mercuric chloride is unsuitable as a spray.

The polysulphides proved to be much more effective both as actual fungicides and as protectants against *C. fulvum* and *V. inaequalis* (the only two tested) than the monosulphide or colloidal sulphur. The use of the two latter, therefore, can only be recommended on sulphur-sensitive plants, to which the polysulphides tend to be phytotoxic. The combination of lead arsenate or lime or iron sulphate with the polysulphides did not materially alter their fungicidal properties, as tested against *C. fulvum,* and hence there is no objection on this ground to their incorporation.

Bailey (D. L.). **Canadian plant pathology in retrospect and prospect.**—*Agric. Inst. Rev.*, i, 1, pp. 41–52, 1945.

This address to the Annual Meeting of the Canadian Plant Pathological Society at Saskatoon on 26th June, 1945, refers to some outstanding past achievements of Dominion plant pathologists and to various urgent problems awaiting attention, concluding with a discussion of the future of the service, especially in relation to the organization, training, and payment of personnel.

Smith (G.). **Presidential address. Mycology and the war.**—*Trans. Brit. mycol. Soc.*, xxix, 1–2, pp. 1–10, 1946.

After noting the increased awareness of, and interest in, mycology during the war, particularly the appreciation of the work of plant pathologists in protecting crops from disease, the author, in this presidential address to the British Mycological Society, discusses notable developments in the protection against fungal attack of industrial goods, particularly those destined for use in tropical climates, and progress in studies of the antibiotic activities of fungi and the industrial development of yeast products.

Miller (P. R.). **Some psychological aspects involved in conducting plant disease surveys : personal bias a factor to be reckoned with in estimating and evaluating plant disease losses.**—*Plant Dis. Reptr*, xxx, 3, pp. 74–77, 1946. [Mimeographed.]

The majority of scientifically minded growers whose aid, based on a rich background of practical experience and local knowledge, is invaluable to plant-disease surveyors, appear to fall into two well-marked groups, one of which tends to exaggerate and the other to minimize the importance of a disease in any given year [cf. *R.A.M.*, xxv, p. 227]. For the carrying-out of surveys on a large scale the institution of a brief course of training for intending participants is suggested, during which standardized trials in the estimation of losses among various crops would be undertaken in fields where actual figures could be determined. The writer believes that surveys have great potential value in securing basic phytopathological information for research- and extension-workers, but issues a note of warning against attaching too great importance to surveys involving only approximations.

Grainger (J.). **Ecology of the larger fungi.**—*Trans. Brit. mycol. Soc.*, xxix, 1–2, pp. 52–63, 1 diag., 5 graphs, 1946.

The author, in this provocative introductory study, shows that most species of the larger fungi have a predilection for acid soils, but there are some which prefer alkaline situations. Mushrooms, for example, have not been found on substrata below pH 5·8. Pronounced disposition to one or other reaction is observed in some genera, notably in coprophilous species, while most humicolous Basidiomycetes need a high average water content in the substrate. As a result of ploughing up, liming, and re-seeding old pasture land near Huddersfield, Yorks., considerable changes in the fungus flora took place and *Russula nigricans* was the sole survivor of eight species, although *Amanita rubescens* was still found on an unploughed headland, to which lime had been added (pH 5·8). Change in water-retention by ploughing is considered to be the determining factor in this elimination from tilled soil. A felling of oaks and beeches in 1942 was followed by the disappearance of *Boletus chrysenteron*, a fungus often found far from woods, and the disturbance of the water content is again regarded as the causal factor.

While *Psalliota campestris* will grow and fruit at any time of year under suitable conditions of climate and nutrition, as do the larger Basidomycetes when grown

in artificial media, natural conditions impose an autumn maximum, governed, it is suggested, by the simultaneous occurrence of a sufficiently high soil temperature, moisture content, and adequate available nitrogen [*R.A.M.*, xxii, p. 103].

Studies of lignicolous fungi showed that *Xylaria hypoxylon* favours wood which is approaching neutrality but only slightly reduced in hardness. *Fomes annosus*, however, grows on wood which retains only 20 to 25 per cent. of its original hardness, but remains fairly acid at pH 5, and two different types of decay may be represented by these examples. The sequence of fungi on fallen logs depends mainly on the stages of decay, but the fungi also contribute to the process. *Trametes mollis* reduced the hardness of wood to about 27 per cent. of its original value, while *F. annosus* caused an 80 per cent. reduction and *Volvaria volvacea* was growing on wood whose hardness was 25 to 32 per cent. of that on which the fungus was not growing.

MOORE (W. C.). **New and interesting plant diseases.**—*Trans. Brit. mycol. Soc.*, xxix, 1–2, pp. 90–94, 1946.

The finding of a *Heterosporium* on *Allium* in Sussex by the author and J. R. Booer in June, 1945, is the fourth occasion on which the fungus has been reported in Britain on this host [*R.A.M.*, xiv, p. 423], and was associated with considerable leaf-blotching among autumn-sown White Lisbon onions. The leaves bore one or more elliptical, depressed, pale brown spots, up to $1\frac{1}{2}$ by about $\frac{1}{4}$ in., enlarging later and, particularly where several appeared on the same leaf, causing the distal portions and the tissues surrounding the spots to become pale or yellow and withered. A pale, powdery agglomeration in the centre of the spot, subsequently developing into a larger brown or deep brown mat, represented the olive-brown conidiophores and pale olive-brown conidia of *Heterosporium*. The conidiophores were more or less rigid, appearing from the stomata singly or in bundles of two or three, mostly septate, nodular, slightly swollen at the tip, and measuring 90 to 120 by 5 to 6 μ. The conidia were verrucose, extremely irregular in size and shape, often unicellular and then usually pyriform, but mostly bicellular and cylindrical, averaging 58 by 16 μ on young spots and 37 to 106 (74) μ long on those showing the maturer brown mat.

While disposed to agree with Jacques [ibid., xxii, p. 179] that small variations in measurements due to age and environmental conditions or the occurrence of *Heterosporium* on different suscepts did not justify the retention of several European varieties, the author concludes that the dimensional differences in *Heterosporium* on onion and other species of *Allium* are so pronounced as to justify provisionally, at any rate, the erection of a varietal distinction between *H. allii* Ell. & Mart. on leek, shallot, chives, and garlic, and the form on onion, for which the name *H. allii* Ell. & Mart. var. *cepivorum* Nicholas and Aggéry [ibid., vii, p. 218] is valid, *H. allii-cepae* Ranojević being a synonym. The variety on leek, *H. allii* var. *allii-porri*, is synonymous with *H. allii*.

A leaf spot of *Helianthemum vulgare* Gaertn. observed by Miss Gooby in July, 1945, on living leaves of pink- and red-flowered (but not on the yellow) hybrids of *H. vulgare* at Harpenden is described and thought to be identical with *Septoria chamaecisti* reported on living leaves of *H. chamaecistus* (*H. vulgare*) in Sweden by Vestergren in 1896. Apparently it has not been observed elsewhere.

GILBERT (W. J.) & HICKEY (R. J.). **Production of conidia in submerged cultures of Penicillium notatum.**—*J. Bact.*, li, 6, pp. 731–733, 1946.

The formation of conidia in submerged shake-flask cultures of *Penicillium notatum* [*R.A.M.*, xxv, p. 408] NRRL 832 has been induced in a variety of media, without the addition of heavy metals, under conditions favouring slight or moderate growth, thereby permitting good aeration, and the maintenance of a pH between

5 and 6·5. Submerged sporulation was effected by these means in media supplied with nitrogen by maize steep water, ground or malted wheat, or thin-grain stillage from yeast-fermented wheat mash.

The addition of iron [ibid., xviii, p. 609] to a basal maize steep water-lactose medium at the rate of 100 μgm. per ml. did not materially interfere with penicillin production or promote conidial formation, but at 500 to 1,000 μgm. the mineral suppressed penicillin titres, lowered pH, and stimulated submerged sporulation; at 2,000 μgm. there was marked inhibition of mould growth.

RAPER (K. B.) & FENNELL (DOROTHY I.). **The production of penicillin X in submerged culture.**—*J. Bact.*, li, 6, pp. 761–777, 1 fig., 3 graphs, 1946.

Of several superior penicillin-producing strains investigated, *Penicillium chrysogenum* NRRL 1984.A, a substrain of Minn. R–13, proved to be the most active yielder of chloroform-insoluble penicillin, or penicillin X, in submerged culture [*R.A.M.*, xxv, p. 407]. By ultra-violet irradiation [ibid., xxv, p. 307] a substrain of 1984.A, designated NRRL 1984. N22, was developed, which gave substantially higher yields of penicillin X, generally amounting to roughly 50 per cent. of the total production as measured by differential assays, and representing 65 to 70 per cent. of the total yield on a weight basis.

STEFANIAK (J. J.), GAILEY (F. B.), BROWN (C. S.), & JOHNSON (M. J.). **Pilot plant equipment for submerged production of penicillin.**—*Industr. Engng Chem.*, xxxviii, 7, pp. 666–671, 2 figs., 3 diags., 3 graphs, 1946.

Equipment for penicillin production in 100-gal. tanks is described. It comprises, besides a tank for producing inoculum and two fermenters, a number of accessory pieces, including a small, cylindrical tank for the measurement of inoculum, antifoam vessels, air filters, and agitators. By means of this installation, penicillin yields exceeding 200 units per ml. could be reproducibly obtained with *Penicillium chrysogenum* culture NRRL 1951–B25 and 400 with X–1612 (Carnegie) [*R.A.M.*, xxv, p. 408]. An aeration rate of one volume of air per minute per volume of medium was found to be optimal, and agitation was essential. Metal-toxicity tests on *P. notatum* NRRL 832 showed aluminium and Allegheny metal to be non-toxic, whereas a total iron content of 500 μgm. per ml. and upwards in the fermentation medium reduced the penicillin yields in shake flasks.

STANLEY (N. F.). **The biological activity of a substance resembling gliotoxin produced by a strain of Aspergillus fumigatus.**—*Aust. J. exp. Biol. med. Sci.*, xxiv, 2, pp. 133–138, 2 graphs, 1946.

The preparation and the biological and chemical properties of aspergillin, an anti-bacterial substance produced by *Aspergillus fumigatus* [cf. *R.A.M.*, xxv, p. 271], are described, the chemical analysis being supplied by J. A. Mills. Evidence adduced from the melting-point, solubility, anti-bacterial activity, lethal dosage for mice, specific rotation, and the chemistry of derivatives of aspergillin points to its close similarity to, if not identity with, gliotoxin [ibid., xxiii, p. 268].

HYDE (H. A.) & WILLIAMS (D. A.). **A daily census of Alternaria spores caught from the atmosphere at Cardiff in 1942 and 1943.**—*Trans. Brit. mycol. Soc.*, xxix, 1–2, pp. 78–85, 2 graphs, 1946.

The daily incidence of *Alternaria* spores [*R.A.M.*, xvii, p. 243; xxi, p. 452, *et passim*], believed mainly to have originated on local cereal crops, as determined over the city of Cardiff by counts made on gravity slides, showed a maximum incidence confined roughly to the period June to September, when they may consti-

tute up to 96·5 per cent. of the total. They are practically absent during the autumn and winter. The considerable variations between the daily catches are thought to be influenced by meteorological factors and there is some correlation with maximum temperature, though none apparently with wind velocity. Rainfall sometimes seems to have been responsible for a temporary drop in the number recorded. The rapid fall in September is suggested to be due more probably to removal of the nutritional substratum of the fungus than to the effect of lower temperatures on rate of spore production.

VICKLUND (R. E.). **Preventing the fungus fouling of optical instruments.**—*Industr. Engng Chem.*, xxxviii, 8, pp. 774–779, 5 figs., 1 diag., 1 graph, 1946.

The deterioration of optical glass through fungal growth on lenses and prisms, commonly known as 'fungus fouling', constitutes a serious problem in tropical areas. With a view to its control, radium sulphate was incorporated into a metallic foil, which was subjected to mycological and physical tests to determine the fungicidal efficacy and practicability of such a treatment. The organisms against which protection is sought include *Aspergillus niger*, *A. versicolor*, *A. oryzae*, *A. flavus*, *Penicillium citrinum*, *Monilia* [*Neurospora*] *crassa*, *Hormodendrum* sp., *Trichoderma* sp., *Stemphylium* sp., *Mucor* sp., *Spicaria* sp., *Chaetomium globosum*, and *Rhizopus* sp.

The results indicated that radium-activated foil will prevent fungal development on the instruments provided the radium is present in a concentration of 15 μgm. per sq. in. in equilibrium with its decay products. Lenses up to 3 in. in diameter can be adequately protected by surrounding each surface with a strip of foil equal in width to one-ninth of the lens radius. The fungistatic effect of the radium-activated foil was shown to be due to alpha radiation. No risk to health is incurred by the use of transits, binoculars, and the like surrounded by radium-activated foil, and the treatment, though initially costly, is believed to be economically feasible, since subsequent servicing is unnecessary and the foil from worn instruments can be cleaned and re-used.

MARSH (P. B.) & BUTLER (MARY L.). **Fungicidal activity of bisphenols as mildew preventives on Cotton fabric.**—*Industr. Engng Chem.*, xxxviii, 7, pp. 701–705, 1 fig., 1946.

Biological tests were carried out to determine the fungicidal potency as preventives of mildew (*Metarrhizium glutinosum*, *Chaetomium globosum*, and *Aspergillus niger*) on 8-oz. cotton duck [*R.A.M.*, xxiv, p. 428] of a group of bisphenols and related compounds. The substitution of two chlorine or two bromine atoms for hydrogens in the positions *para* to the phenolic hydroxyls invariably increased fungicidal activity over that observed with the unhalogenated diphenols, but further symmetrical halogen substitution resulted in compounds tending, in some cases definitely, to be less potent than the dihalogen derivatives. Thus, 2,2′-methylenebis (4-nitrophenol) was entirely devoid of measurable fungicidal activity at any of the concentrations tested up to 0·4 per cent., and the same was true of chlorine-substituted derivatives of 2,2′-methylene diphenol in which both phenolic hydroxyls had been blocked by formation of ether linkages. Three- and four-ring compounds containing *para*-cresol or *para*-chlorophenol units joined by methylene bridges were distinctly less effective than the corresponding bisphenols. None of the compounds tested was found to be more fungicidal per unit weight on the fabric than 2,2′-methylenebis (4-chlorophenol) No. 11, known commercially as 'compound G–4', which has been extensively used as a preservative for the last three years.

The various methods of testing the efficacy of mildew-preventives used in these experiments are briefly discussed.

Race (E.), Rowe (F. M.), & Speakman (J. B.). **The dyeing of Cotton with mineral khaki. Part VII. The fungicidal and bactericidal efficiencies of Cotton yarn treated by various mineral khaki processes. Part VIII. The incorporation of copper with chromium and iron in mineral khaki for the production of an effective fungicide and bactericide.** Race (E.) & Rowe (F. M.). **Part IX. The effect of exposure to weathering agencies on yarns pigmented with copper, chromium and iron compounds.**—*J. Soc. Dyers*, lxi, 12, pp. 311–321, 4 figs. (1 col.), 1 diag., 4 graphs, 1945; lxii, 1, pp. 9–29, 10 figs., 18 graphs, 1946.

The following information of mycological interest is selected from the three concluding instalments of this exhaustive study, conducted at the Clothworkers' Research Laboratory and Textile Chemistry Laboratory of Leeds University, on the practice of cotton dyeing with mineral khaki [*R.A.M.*, xxv, p. 132]. The only toxic principle in a chrome iron-treated yarn inoculated with *Metarrhizium anisopliae*, an exceptionally active cellulose-destroyer, was found to be hexavalent chromium, the trivalent chromium and iron components of the compound merely conferring a degree of resistance on the material but not immunity from infection. Even the effects of the hexavalent chromium, moreover, are purely transient, since the chemical is subject to hydrolysis and reduction by cellulose.

In the case of cotton inoculated with a mixed bacterial and fungal culture, the moisture content is an important factor in the nature of the microbiological agents of deterioration, bacteria predominating at 38 to 39 per cent., the lower fungi at 29 to 31, and the latter and Basidiomycetes at 25 to 27. It is important, therefore, in comparative tests, e.g., by the soil-burial and other 'contact' methods, to maintain the moisture content of all the samples at a uniform level. Of the various testing techniques in current use, the usual practice of burying the samples vertically in a considerable amount of soil, with or without an admixture of horse dung, is regarded as inexact, and the writers prefer to place the samples horizontally between layers of prepared horse dung in Petri dishes at a constant temperature of 30° C.

In tests by the foregoing and other methods, including inoculation of the yarn with a pure culture of *Chaetomium globosum* in the presence of a nutrient medium and with free access of air, comparatively small amounts of copper carbonate in conjunction with iron or chromium and iron conferred protection against cellulose-decomposing and other fungi. To ensure optimum results the pigment on the fabric should have a copper content of not less than 0·5 per cent., or in mixtures of copper, chromium, and iron, or copper and iron, minimum total oxide contents of 2 and 1·4 per cent., respectively. The concentration of chromium oxide in the impregnating liquor should not exceed 4·8 gm. (32 gm. chrome alum) per l.

Two series of exposure tests, covering periods of 36 and 12 weeks, respectively, were carried out on yarns proofed with chromium, copper, and iron in different combinations and with various copper compounds, using specially constructed teak frames with 12 wooden pegs along each side to facilitate accuracy and speed. Every fourth week of the first trial, attempts made to culture cellulose-decomposing micro-organisms from the exposed yarns were unsuccessful, indicating that degradation of cotton, free from contamination by soil of other nutriment-providing materials, during exposure in an industrial region, is caused exclusively by weathering agencies. The leaching of chromium from chrome-tinted or mineral khaki-dyed fabric under these conditions is not excessive, and still less iron is lost through exposure, but the reduction in the copper content is extremely heavy. Thus, in the second trial, from 6th November, 1944, to 29th January, 1945, when the pH values of atmosphere, rain, and snow were as low as 3·1, at least 94 per cent. of the original amount of copper disappeared from the yarns treated with cuprammonium hydroxide, copper carbonate, copper-chromium, and copper-iron and 88·3 per cent. from the samples impregnated with copper naphthenate. During the same period the losses in ten-

sile strength of the copper-treated materials were roughly 30 per cent., and it therefore appears unlikely that any of the compounds now used as rot-proofers will withstand lengthy exposures in the acidic atmosphere of English industrial centres.

Milner (M.) & Geddes (W. F.). **Grain storage studies III. The relation between moisture content, mold growth, and respiration of Soybeans.**—*Cereal Chem.*, xxiii, 3, pp. 225–247, 4 graphs, 1946.

The influence of moisture content on the respiratory functions of Illini soy-beans at 37·8° C. was studied at the Minnesota Agricultural Experiment Station by a technique providing for the simultaneous measurement of oxygen consumption and carbon dioxide production, under conditions of continuous and controlled aeration, for periods up to 15 days.

Moisture values below 14 per cent. yielded very low and virtually constant respiratory rates over protracted periods, but small increments of moisture above this point were accompanied by respiratory increases due to mould (principally *Aspergillus flavus* and *A. glaucus*) growth. The latent period of mould spore germination decreased with increasing moisture content. Frost-damaged seeds showed shorter respiratory lag periods and considerably higher respiration rates than did high-grade material at similar moisture levels, as well as a significantly lower critical moisture value than sound seeds. These differences are attributed primarily to the greater concentration and ease of availability of nutrients for mould growth in damaged as compared with healthy seeds. At moisture levels permitting mould proliferation, drastic changes occurred in the chemical composition of the seeds, as estimated by oil acid value and total and reducing sugars. Significant increases in the moisture content of soy-bean seeds maintained in atmospheres of constant humidity in equilibrium with seed moisture were noted in cases of extensive mould growth.

A. glaucus was the most xerophytic of the moulds encountered in these trials, apparently commencing growth at a seed moisture content of 14 per cent., corresponding to a relative atmospheric humidity of 75 per cent. *A. flavus* required a moisture value about 3 per cent. higher for germination. Relative humidity rather than the actual moisture content of the seeds is believed to determine their susceptibility to storage moulds.

Christensen (C. M.). **The quantitative determination of molds in flour.**—*Cereal Chem.*, xxiii, 3, pp. 322–329, 1946.

Of several media tested for the determination of moulds in flour at the Minnesota Agricultural Experiment Station, the best consisted of 20 gm. malt extract, 75 gm. sodium chloride, 20 gm. crude shredded agar, and distilled water to make up to 1 l. *Aspergillus candidus*, *A. glaucus*, and other common and abundant occupants of flour make rapid growth on the substratum (pH 5), the high salt concentration of which entirely inhibits bacterial development. A higher mould count is obtained from a given sample on the malt-salt medium if the flour is suspended in sterile saline solution, and this suspended in the agar, than if it is similarly suspended and cultured on the surface of the medium or spread dry over the latter.

Cathcart (W. H.). **High frequency heating produces mold-free bread.**—*Food Industr.*, xviii, 6, pp. 98–99, 3 figs., 1946.

Mould growth in wrapped, sliced bread was experimentally shown at the National Bakery Division Laboratory, the Great Atlantic and Pacific Tea Co., New York, to be preventable by through-heating with electric current at frequencies of approximately 15 megacycles, using a 3-kw. output radio-frequency unit, with an input of 5 kw., an overall efficiency of 55 per cent., and a possible power factor of slightly

above 90 per cent. The treatment raised the temperature of a 20-oz. loaf from that of the room to the 140° F. necessary to ensure sterility in 50 seconds, and no mould developed in three weeks' subsequent storage at room temperature.

LINDEBERG (G.). **Thiamin and growth of litter-decomposing Hymenomycetes.**—*Bot. Notiser, 1946*, 1, pp. 89–93, 1946.

Most of the Swedish litter-decomposing Hymenomycetes [see next abstracts] included in this study on the influence of thiamin on growth were shown to be heterotrophic in respect of the vitamin, among those reacting most favourably to its admixture with the nutrient solution at a dosage of 50 γ per l. being *Clavaria ligula*, *Collybia ambusta*, *Flammula penetrans*, *Mycena vulgaris*, and *Pholiota mutabilis*. The dry weight of the mycelium (in mg.) of these species was raised from 0·7 to 115·4, 1 to 110·2, 0·5 to 109·1, 1·3 to 193·1, and 2·1 to 134·3, respectively, by the growth substance. *Clitocybe geotropa* and *Hypholoma fasciculare* produced, respectively, 5·1 and 7·4 mg. mycelium without the addition of thiamin, and it may therefore be assumed that they are to some extent auxo-autotrophic in this respect, though insufficiently so for optimum development.

MELIN (E.). **Der Einfluss von Waldstreuextrakten auf das Wachstum von Bodenpilzen, mit besonderer Berücksichtigung der Wurzelpilze von Bäumen.** [The influence of litter extracts on the growth of soil fungi, with special reference to the root fungi of trees.]—*Symb. bot. upsaliens.*, viii, 3, 116 pp., 40 graphs, 1946. [English summary.]

Extracts were prepared from the dead leaf and needle litter of *Acer platanoides*, birch (*Betula verrucosa*), beech, Scots pine (*Pinus sylvestris*), aspen (*Populus tremula*), oak, and elm (*Ulmus glabra*) [see preceding and next abstracts], and from the straw and foliage of *Glyceria maxima* [*R.A.M.*, xxiv, p. 472] and tested for their effects on some mycorrhizal fungi of conifers, viz., *Boletus elegans*, *B. granulatus*, *B. luteus*, *B. variegatus*, *Lactarius deliciosus*, *Paxillus prunulus*, *Rhizopogon luteolus*, *R. roseolus*, and *Tricholoma imbricatum*; the non-mycorrhiza-forming *M*[*ycelium*] *r*[*adicis*] *atrovirens*, which commonly occurs as a parasite in forest tree roots [ibid., xxi, p. 390; xxiv, p. 464]; and the saprophytes *Morchella conica*, *Psalliota arvensis*, *Clavaria dendroidea*, *C. flaccida*, *C. gracilis*, *C. ligula*, *Clitocybe infundibuliformis*, *C. geotropa*, *Collybia dryophila*, *Mycena epipterygia*, and *Stropharia aeruginosa*; while *Phycomyces blakesleeanus* [ibid., xxiii, p. 311] was included for comparative purposes.

All the types of litter contained water-soluble substances promoting in varying degrees the mycelial development of the thiamin-heterotrophic species tested, i.e., the mycorrhizal Hymeno- and Gasteromycetes and the litter-decomposing Hymenomycetes. In general, the relative growth increase in the mycorrhizal organisms ranged from 150 to 300 per cent., but even larger increments were occasionally obtained, notably in the case of *L. deliciosus*, the production of which reached a maximum of 60 times that of the controls without extract. The litter-decomposing Hymenomycetes were also benefited in a striking manner by the extracts. *R. luteolus* and *R. roseolus* in particular responded to minute quantities; the maximum stimulus, however, was usually exerted by additions of 10 to 20 mg. (dry substance) per ml. medium.

The fungi varied in their reactions to the ash constituents of the litter extracts, the growth of *B. variegatus* A and *Clavaria dendroidea*, for instance, not being promoted at all, while *R. luteolus* and *R. roseolus* responded feebly, and the stimulus afforded to *B. variegatus* B, *B. granulatus*, *B. luteus*, and *L. deliciosus* was considerable. The lower limit of the growth-promoting effect of the ash constituents of aspen leaf litter was 0·001 per cent. or less, a peak generally being reached between 0·01 and 0·2 per cent. As already indicated by Lindeberg's experimental results

and those (unpublished) of Birgitta Norkrans, the stimulatory property of the litter resided in its calcium and manganese content, probably supplemented by one or more growth substances which expedited the development of the test fungi [see preceding abstract], including the parasite *M.r. atrovirens*.

Particular interest attaches to the experiments on *B. variegatus* A and *C. dendroidea*, which represent two distinct types of growth response, the amount of fungus substance produced by the former being out of all proportion to the suboptimal supplement of litter extract, whereas in the latter species the increment was in reasonable relation to the accessory factor. There is cogent circumstantial evidence that the content of the litter extracts includes, besides known growth substances such as thiamin and biotin, one of unknown identity found by Robbins (*Amer. J. Bot.*, xxvi, 1939; xxvii, 1940; *Bot. Gaz.*, ci, 1939; cii, 1941) and Robbins and Hanmer (*Bot. Gaz.*, ci, 1940) to promote the development of *P. blakesleeanus* and named by them factor Z. Response to this substance was of two different types, (1) the *Phycomyces* type, characteristic of *P. blakesleeanus* and most of the other fungi tested, consisting in a more or less marked acceleration of the growth rate, though satisfactory development was made without the supplementary factor; and (2) the *Clavaria* type, represented by *C. dendroidea*, which made only insignificant growth in the absence of Z, at any rate in the early stages. No evidence was obtained to support the assumption of Robbins and Kavanagh (*Proc. nat. Acad. Sci., Wash.*, xxviii, 1942) and Robbins (ibid., xxix, 1943) that factor Z is identical with hypoxanthin.

A. platanoides, birch, beech, oak, aspen, and pine leaves also contained water-soluble substances inhibiting or preventing the growth of certain soil Hymenomycetes, notably the mycorrhiza, the litter-inhabiting and decomposing species being impervious to their influence. The physical and chemical properties of these antibiotic principles have not yet been fully studied. Autoclaving the cold water extracts at 120° C. resulted in some cases in an intensification of their inhibitory properties, in respect both of the mycorrhizal and litter-decomposing fungi; this effect was particularly noticeable in the tests with *A. platanoides* litter extract. The aqueous extract of *G. maxima* did not impede the growth of any of the experimental fungi.

MELIN (E.) & WIKÉN (T.). **Antibacterial substances in water extracts of pure forest litter.**—*Nature, Lond.*, clviii, 4006, pp. 200–201, 1946.

As a result of testing cold water extracts of pure litter of Swedish forest trees [cf. *R.A.M.*, xxiii, p. 220 and preceding abstracts] of the species *Acer platanoides*, birch (*Betula verrucosa*), beech, ash, aspen, oak, and elm (*Ulmus glabra*), for antibacterial properties against *Staphylococcus aureus* No. 266 in the light of the senior author's previous findings, only *A. platanoides* and, to a lesser extent, oak were found to contain antibiotic agents effective against the pathogen under the assay methods used.

WINGE (O.). **Croisement inter-spécifique chez les champignons.** [Interspecific hybridization among fungi.]—*Sci. genet.*, ii, 2–3, pp. 171–189, 9 figs., 1942. [Latin, English, and German summaries. Received August, 1946.]

In studies of hybridization in fungi it is important to differentiate between (*a*) hybrids composed of cells containing specifically distinct, haploid nuclei which have not fused (dicaryophytic species hybrids), and (*b*) hybrids resulting from the fusion of specifically different, haploid nuclei to form a diploid hybrid nucleus (true species hybrids).

Various experiments on fungal hybridization from the relevant literature are discussed, and the conclusion is reached that very few true species hybrids are known.

FRIES (N.). **X-ray induced parathiotrophy in Ophiostoma.**—*Svensk bot. Tidskr.*, xl, 2, pp. 127–140, 1946.

Out of 94 X-ray-induced physiological mutations of *Ophiostoma multiannulatum* [*Ceratostomella multiannulata*: *R.A.M.*, xxv, p. 133], 13 were parathiotrophic, i.e., incapable of assimilating hexvalent sulphur (as sulphate or sulphone). Among compounds containing bivalent sulphur, cystein and cystin served as valuable sources of sulphur for the mutants, while sodium and ammonium sulphides and tri-methyl-sulphide-metan were also assimilable. It appeared from mating experiments that the reduction of sulphate in *C. multiannulata* is controlled by at least three distinct genes. Five of the parathiotrophic mutants were capable of reversion to the normal state of euthiotrophy in a medium with sulphate as the sole source of sulphur.

FRON (G.) & MAGROU (J.). **Le problème de la Pomme de terre.** [The Potato problem.]—*C. R. Acad. Agric. Fr.*, xxvi, 22, pp. 809–824, 1940. [Received August, 1946.]

In 1938 Magrou, starting with uninfected seeds growing in a nutrient solution, obtained the formation of potato tubers on some of the plants in the absence of symbiotic mycorrhiza [*R.A.M.*, xxiv, p. 332]. Further experiments showed that tuberization depended on a certain minimum of sugar in the medium. In further *in vitro* work, Magrou germinated aseptic potato seeds and in three or four months they produced young plants with asymbiotic, primary tubers. Planted at once in soil rich in mycorrhiza, these gave plants which, protected from all further infection, the following summer gave secondary symbiotic tubers. Replanted the following March in ordinary conditions, they yielded an abundant crop. Thus, from one aseptic seed in 18 months (using symbiosis) a harvest of 83 tubers weighing over 10 kg. was produced.

Magrou and his co-workers have (1940) in their laboratory at the Pasteur Institute 30,000 tubes, each sown with 5 or 6 seeds. If only one-tenth give primary tubers and these can be planted in soil containing suitable mycorrhiza several tons of seed potatoes more likely to be free from degeneration diseases than any others could be obtained. It is claimed that genetically selected strains can be tried out much more rapidly by this method.

Magrou states that, using the symbiotic cultivation of potatoes in the Pyrenees, sowings give 26 to 64 tubers per stool. These primary tubers, replanted in the same mycorrhiza-containing soils, provide abundant 'seed' of exceptional quality.

To apply in practice and on a large scale the symbiotic method, the uncultivated districts of France rich in plants showing mycorrhiza should be selected. Test plantings should be made, and where the location seems favourable primary tubers should be planted in unmanured ground. This will give an abundant crop of seed tubers in the second year. If the work is done at a distance from any other potato field the risk of virus disease will be reduced to a minimum.

The use of aseptic primary tubers raised from seeds in glucose solution will eliminate the remotest risk of virus contamination if when planting in the fields containing mycorrhiza protection is given against insects; or early plantings could be made in Mediterranean areas and harvested before the insect vectors of virus diseases appeared.

GIGANTE (R.). **Esperienze d'orientamento sulla 'maculatura ferruginea' dei tuberi di Patata.** [Exploratory experiments on rust spot of Potato tubers.]—*Boll. Staz. Pat. veg. Roma*, N.S., xx, 3, pp. 189–204, 3 figs., 1940. [Received June, 1946.]

'Maculatura ferruginea' [Eisenfleckigkeit = internal rust spot] of potato tubers [*R.A.M.*, xv, p. 249] in some years causes serious losses in Italy [ibid., xxv, p. 439],

where it is sometimes exceptionally severe on the varieties Pepo and Parnassia. From numerous inspections of affected potato fields it appeared that the disease followed on the planting of affected tubers.

To test the possibility of tuber transmission affected Parnassia tubers from the vicinity of Como were cut in half (to make sure they were affected) and the halves planted in separate holes. Nine plots of 100 holes each were planted to affected half-tubers and one to apparently unaffected half-tubers derived from affected plants. Of the nine plots one was left untreated as a control; the other eight had been treated as follows: manganese sulphate (3 gm. per sq. m.), sodium tetraborate (3 gm.), potassium chloride (5 gm.), powdered sulphur (100 gm.), lime (100 gm.) plus calcium superphosphate (40 gm.), lime (100 gm.), iron sulphate (5 gm.), and gypsum (50 gm.). Planting was carried out in April, 1940. In the vicinity of Rome where the first set of experiments was carried out the soil was argillaceous, very compact, and neutral. Growth was excellent and no sign of disease appeared on any plant. In August the potatoes were dug. The untreated control plot, the plot with apparently healthy half-tubers, and those given the treatments listed above then showed, respectively, 60, 57, 50, 50, 54, 60, 64, 49, 55, and 50 per cent. internal rust spot.

The same experiment at Avellino in south Italy (volcanic soil, pH 7·2, 380 m. above sea-level) gave a percentage of affected tubers derived from diseased half-tubers of 62 to 65, and from apparently healthy half-tubers from 50 to 55. At Trento in north Italy (light, sandy soil, neutral reaction, 200 m. above sea-level), the corresponding figures were 5 to 7 and not over 2 per cent.

It is concluded that internal rust spot is unquestionably transmitted through affected seed pieces. It is also stated to be transmissible by apparently healthy tubers obtained from plants that have given affected tubers.

HOLMBERG (C.). **Potatiskräfta och Potatisål i Sverige år 1945.** [Potato wart and Potato eelworm in Sweden in the year 1945.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1946*, 2, p. 28, 1946.

During 1945 potato wart [*Synchytrium endobioticum*] was reported from 118 allotments distributed over 35 parishes in 11 provinces of Sweden [cf. *R.A.M.*, xxv, p. 137], 18 of the new foci originating in eight districts hitherto free from the disease. The province of Scania harboured most of the new cases, with Kristianstad as the main reservoir of inoculum, whence 183 fresh outbreaks were recorded from 1941 to 1945, as compared with 98 from 1928 to 1940.

HOLMBERG (C.). **Fortsätta fältförsök rörande Potatiskräftans bekämpande.** [Continued field experiments on Potato wart control.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1946*, 1, pp. 13–14, 1946.

Further experiments in Sweden to determine the duration of persistence in the soil of the potato-wart fungus [*Synchytrium endobioticum*: *R.A.M.*, xxv, p. 136 and preceding abstract] generally confirmed those already obtained. The inoculum apparently dies out with the protracted cultivation of immune varieties or non-susceptible kitchen-garden crops, whereas it was still infective after 16 to 17 years in ground allowed to revert to grass.

LUTMAN (B. F.). **The spread of Potato scab in soil by Potato plant humus.**—*Bull. Vt agric. Exp. Sta.* 528, 40 pp., 12 figs., 1945.

The belief that potato scab (*Actinomyces chromogenus*) [*A. scabies*] [*R.A.M.*, xxv, p. 356] is spread by infected tubers is considered to have cost growers millions of dollars in uselessly disinfecting seed [ibid., xxiii, p. 508]. The Actinomycetes in the soil have been shown to come from mycelium or resting spores in the decaying plant remains. Where, therefore, the soil is known to favour the growth of the

pathogen all potato plants should be removed, even at the expense of the humus. As far as is practicable, the tops should be removed for manuring other crops.

The vertical stems of potato plants from plots infected by *A. scabies* showed typical browned and cracked scab lesions, and many lenticels on the white stolons which terminated in badly scabbed tubers were brown, slightly enlarged, and elongated. Young potato roots, at first white, soon develop brown spots of varying sizes located in the cortex. Some cell walls in the tangential and cross sections of the roots were browned and swollen and appeared to enclose pigment-excreting filaments which are the same as those in the skin of young tubers near young scab lesions and are undoubtedly growths of chromogenic Actinomycetes [loc. cit.]. The structure of all cortical cell walls was complex, but only a few had the brown discoloration.

Actinomycetes were isolated from soil and humus by using a differential medium of pectin, arabinose, and inorganic salts with a pH of 5·6 (rendering the pectin unavailable except to a few bacteria), used either as a liquid or as a gel by incorporating 0·5 per cent. agar. *Actinomyces* germ-tubes developed invariably from within thoroughly disintegrated potato plant particles from two- to seven-year-old compost. No conidia or conidial germ-tubes were seen. In a few cases germination seemed to have occurred at both ends of a short mycelial thread. Where similar germinations were secured from finely powdered potato leaves composted the previous year, the fragments were still recognizable as plant cells, but it was not possible to determine with any accuracy the origins of the germinating hyphae which grew from them. The presence of Actinomyces hyphae of different diameters suggested the occurrence of more than one species within the plant.

Germination of *A. scabies* was poor until the soil temperature rose from 16° to 18° C. during the first week in June, and the number germinating increased until mid-July, when a fall in the moisture content of the soil to some 6 per cent. of its dry weight, owing to drought, almost stopped the growth of the pathogen; nor did heavy rain later re-establish the rate or number of germinations for several weeks, after which germination went on until December.

The recovery of immense numbers of *A. scabies* per gm. of soil samples preserved for seven years in glass-stoppered bottles, where the soil contained a high percentage of humus and still remained moist, indicated the persistence of the organism in the soil. Potato humus was shown to contain 46 per cent. moisture at a time when soil moisture was only 23 and to be definitely alkaline in reaction by reason of a high population of *A. albus*. It would thus be likely to encourage scab. Soil (pH 6·4) entirely free from *A. scabies* was inoculated with a compost of potato residues of preceding years from badly diseased plants. Tubers planted in this soil developed scab much more severely than those grown in uninoculated soil. It is concluded that a source of infection is provided by *A. scabies*, inhabiting the soil in humus derived from parts of the potato plant other than the tubers.

Lhoste (L.). **À propos de la fusariose de la Pomme de Terre.** [On fusariosis of Potato.]—*Rev. hort., Paris*, N.S., xxx, 6, pp. 103–104, 4 figs., 1946.

This brief, popular note on dry rot of potato (*Fusarium caeruleum*) concludes with the conventional recommendations for securing resistant varieties, interim control measures by careful avoidance of mechanical injury, and storage and sack disinfection with formalin, concentrated solutions of which (15 to 20 per cent.) are necessary for the destruction of the spores [cf. *R.A.M.*, xxv, p. 315].

Gum (O. B.), Brown (H. D.), & Burrell (R. C.). **Some effects of boron and manganese on the quality of Beets and Tomatoes.**—*Plant Physiol.*, xx, 2, pp. 267–275, 2 figs., 1945.

A procedure is outlined suitable for the growth and analysis of crops to determine the effects on quality of various boron and manganese treatments. Data are

given on the effect of boron and manganese deficiencies on the dry matter, reducing and total sugars, alcohol-soluble nitrogen, insoluble nitrogen, and vitamin content of tomatoes and beets. The controls showed slightly more vitamin B_2 than boron- or manganese-deficient plants of both hosts, while only a trace of vitamin B_1 was found in either.

HUNTER (J. G.) & M'GREGOR (A. J.). **Some abnormalities in the nutrition of crops.**—*Scot. J. Agric.*, xxvi, 1, pp. 30–33, 1946.

This report on crop failures in the West of Scotland Agricultural College area supplements an early one [*R.A.M.*, xxiv, p. 467]. It is recommended that extremely acid soils planted to oats and potatoes should receive lime dressings, particularly on light soils and where calcium deficiency occurs owing to omission of lime applications. Top-dressings of hydrated lime applied to young plants induced considerable improvements. Magnesium deficiency seems more widespread than suspected hitherto, notably in the counties of Ayr, Dumbarton, Lanark, Renfrew, Stirling, and west Perth, and in less acid as well as in very acid soils. In acid soils treatment with dolomitic limestone or magnesium marl, applied sufficiently long before sowing to allow of full absorption, should remedy this deficiency. Some potatoes appear particularly susceptible to it, and may require more magnesium than other crops. In the counties of Dumbarton, Lanark, Renfrew, and Stirling swede and oat crops on acid soils showed abnormalities and failure coincidental with the presence in the crops of unusually high manganese concentrations [ibid., xxv, p. 197]. The condition was accompanied by an abnormally high concentration of water-soluble manganese in the soil, and is considered to be due to soil acidity.

BORZINI (G.). **Primo contributo allo studio delle possibilità di una coltivazione artificiale del 'Fomes officinalis' (Will.) Fr.** [A first contribution to the study of the possibilities of an artificial cultivation of '*Fomes officinalis*' (Will.) Fr.]—*Boll. Staz. Pat. veg. Roma,* N.S., xxi, 3, pp. 221–234, 4 figs., 1941. [Received June, 1946.]

Owing to the impossibility of importing *Fomes officinalis* (used for medicinal purposes) [*R.A.M.*, xxiv, p. 472] into Italy during the war the author undertook an investigation into the artificial cultivation of the fungus. A few specimens were found in Val di Sole in the Alpine regions of Italy, at an altitude of about 2,200 m., on the trunks of old larches in poor condition, and occasionally on dead, felled larches.

Fragments of mycelium found under the bark were transferred to potato dextrose agar or the same mixed (before sterilizing) with larch wood sawdust. At 22° to 24° C., colonies began to form after seven or eight days. Transfers were then made on to other media (carrot agar plus dextrose decoction of larch wood, potato dextrose agar plus larch wood decoction, etc.). In agarized larch wood decoction fungal development was almost inhibited at a pH near to or above 6. The addition of a high proportion of larch wood decoction to carrot or potato dextrose agar favoured growth. Development was very satisfactory and the amount of mycelium greatest on larch wood sawdust (pH 4·7). The addition of agar increased the aerial mycelium. On larch wood cylinders the fungus grew readily.

The most successful way to grow the fungus artificially will probably be to inoculate sickly larches with various types of cultures, or to use felled larches or other resinous or even broad-leaved trees. Further studies are in progress.

MARTIN (J. P.). **Pathology.**—*Rep. Hawaii Sug. Exp. Sta., 1944–5* (ex *Printed Reps. Hawaii Sug. Pl. Ass., 1945*), pp. 23–30, 1946.

The six canes sent for testing to Queensland in 1939, namely, 28–4291, 31–2484, 31–2806, 32–1063, 32–3575, and 32–8560 [cf. *R.A.M.*, xxiv, p. 432], proved very

susceptible to Fiji disease. The effect of hot-water treatment on the disease was tried out by A. F. Bell in Queensland. Satisfactory germination occurred after treatment at 55° C. for 20 minutes, but the shoots came up 100 per cent. diseased; 20 minutes' exposure to 56°, 60°, and 62° killed all the buds.

Eye spot [*Helminthosporium sacchari*], mosaic, and root rot [? *Pythium graminicola*] are now considered of secondary importance in Hawaii and the current commercial varieties have shown themselves robustly resistant to them. An eye-spot lesion is rarely found on 32–8560, which is grown on what were formerly areas harbouring this disease. Varieties 32–8560 and 32–1063 have shown not a single case of mosaic. These and other varieties are highly resistant to root rot. Chlorotic streak and leaf scald have also declined in virulence during recent years. Several varieties susceptible to leaf scald [*Xanthomonas albilineans*], such as 28–4291, Yellow Caledonia, and 29–3859, have been replaced with resistant sorts. Potash deficiency was noted in isolated areas of Hawaii on 32–1063, 32–8560, and 31–2484 as they approached maturity.

C. W. Carpenter reports that as a result of inoculating common prickly pear with a variety of *Fusarium oxysporum* [ibid., xxiv, p. 109] the density of the cactus has been sufficiently reduced to allow about 1,000 acres on the Parker Ranch, Hawaii, to be made accessible to cattle. Only the red-fruited variety appears to be susceptible. As this disease does not spread noticeably, it is unlikely that this practice will inconvenience those ranchers who value the cactus as a source of water and feed for their cattle during droughts. In neither the spineless cactus (*Opuntia ficus-indica*) nor in the night-blooming *Cereus* (*Hylocereus undatus* [*Cereus grandiflorus*]) does the disease develop progressively following inoculation. A technique has been developed whereby one man can inoculate several hundred clumps of cactus daily.

In the course of studies, undertaken in co-operation with C. W. Carpenter, concerning the basic nutrient solution for penicillin production, D. M. Weller has shown that when pure dextrin and dextrose were substituted for and in combination with glucose in the solution, the medium containing dextrin was far superior for penicillin production. When lactose was compared with dextrin similar yields of penicillin were obtained, but after 270 days under refrigeration the titre of the lactose medium held up better than that of the dextrin medium. As additional amounts of sulphur dioxide (one of the impurities in glucose syrup) were added to the glucose media, penicillin production decreased accordingly.

Cross (W. E.). **La actuación de la Estación Experimental frente a la crisis producida por el 'carbóne' de la Caña de Azucar.** [The action taken by the Experiment Station in face of the crisis produced by the Sugar-Cane 'smut'.]—*Circ. Estac. exp. agríc. Tucumán* 136, 7 pp., 1946.

This is a summary of the steps taken by the Tucumán Agricultural Experiment Station to overcome the crisis in the Argentine sugar industry occasioned by the outbreak of smut [*Ustilago scitaminea*] in 1943—the most formidable threat to production since the mosaic epidemic of 1916. Lists are given of the immune and resistant varieties already recommended [*R.A.M.*, xxv, p. 183], with the acreages under each according to the latest available data.

McMartin (A.). **Chemotherapy in the propagation of Sugarcane.**—*S. Afr. J. Sci.*, xlii, pp. 122–130, 2 figs., 1946.

The writer recapitulates the results of his experiments in the control of pineapple disease of sugar-cane (*Thielaviopsis* [*Ceratostomella*] *paradoxa*) in South Africa by chemotherapy, which have already been noticed from other sources [*R.A.M.*, xxvi, p. 279].

Tobisch (J.). **Beiträge zur Kenntnis der Pilzflora von Kärnten. VI.** [Contributions to the knowledge of the fungus flora of Carinthia.]—*Öst. bot. Z.*, xci, 2–3, pp. 184–189, 1942. [Received August, 1946.]

Most of the species comprised in this final instalment of the writer's annotated list of Carinthian fungi [cf. *R.A.M.*, xviii, p. 57] are Basidiomycetes, several of which are new records for the region. Mention may further be made of *Ascochyta juglandis* on walnut [ibid., xix, p. 309], not hitherto reported from Carinthia.

Dietel (P.), Eichhorn (E.), & Poeverlein (H.). **Die Rostpilze Kärntens.** [The rust fungi of Carinthia.]—*Öst. bot. Z.*, xcii, 1–2, pp. 50–86, 1943. [Received August, 1946.]

This compilation of Carinthian rusts is based on material collected by the authors on three visits to the Austrian province, supplemented by a perusal of the relevant literature.

Wang (M. C.). **Manual of the plant diseases of Honan Province.**—61 pp., Honan Univ., (?) 1942. [Received 1946.]

This is a list, with an introduction and annotations in Chinese, of the fungal, bacterial, and virus diseases of plants in Honan Province, arranged in alphabetical order under the scientific names of the hosts. A bibliography of 44 titles is appended.

Simpson (Muriel W.) & Talbot (P. H. B.). **An enumeration of fungi collected at Qudeni Forest Reserve, Zululand, in February, 1945.**—*S. Afr. J. Sci.*, xlii, pp. 131–134, 1946.

This is believed to be the first list of fungi from the Qudeni Forest Reserve, Zululand. It consists largely of Basidiomycetes, represented for the most part by Polyporaceae, with a few Ascomycetes.

Raestad (Randi). **The relation between Polyporus abietinus (Dicks. ex Fr.) Fr. and Irpex fusco-violaceus (Ehrenb. ex. Fr.) Fr.**—*Nyt Mag. Naturv.*, lxxxi, pp. 207–231, 1 fig., 2 diags., 1941. [Received September, 1946.]

Polystictus (*Polyporus*) *abietinus* and *Irpex fusco-violaceus* [*R.A.M.*, v, p. 267; xxii, p. 186] are generally regarded as identical by American authors, whereas in Europe it is customary to maintain a distinction between them. In the author's studies at Oslo University, to elucidate the taxonomy of the species, all pairings between Norwegian strains of identical morphology were interfertile, whereas none of those between the typical *Polystictus abietinus* [ibid., xx, p. 613] and the fungus known in Norway as *I. fusco-violaceus* formed clamp-connexions. This intersterility, coupled with constant divergences in hymenial morphology and anatomy and differences in the growth rates and natural substrata, *P. abietinus* occurring on pine, spruce, fir (*Abies*), and larch and *I. fusco-violaceus* on the last-named only, would appear to corroborate the view that the species are distinct, though very closely related in respect of many important features. However, a comparative study of Norwegian and North American specimens (from Canada and the United States) led to a different conclusion. The American material comprised a far larger number of forms and types than are found in Norway, or probably elsewhere in Europe. Some of the American forms are true intermediates between the Norwegian *P. abietinus* and *I. fusco-violaceus*, while others differ, both in size and hymenial morphology, from the strains collected in Norway. The fact that American and Norwegian isolates (both poroid and lamellate) are entirely interfertile is considered to demonstrate that the two European fungi, connected by the American types, are members in a chain of closely related forms belonging to one and the same species.

Discussing the revision in the nomenclature of the species necessitated by this concept, the writer accords priority to De Candolle's name of *Polyporus abietinus*

Fr. (1830), which should be subdivided, at any rate as regards the European forms, into two subspecies, viz., *euabietinus*, corresponding to the Friesian species, *P. abietinus*, and *fusco-violaceus*, agreeing with Fries's description of *I. fusco-violaceus*. The comparatively homogeneous forms of the fungus occurring in Europe have been exhaustively investigated by Donk (*Meded. ned. mycol. Ver.*, xxii, 1933), and his diagnoses of *Hirschioporus abietinus* (Dicks. ex Fr.) Donk and *H. fusco-violaceus* (Ehrenb. ex Fr.) Donk might well be applied to *P. abietinus* subsp. *euabietinus* and *P. abietinus* subsp. *fusco-violaceus*, respectively.

DENNIS (R. W. G.). **Notes on some British fungi ascribed to Phoma and related genera.**—*Trans. Brit. mycol. Soc.*, xxix, 1–2, pp. 11–42, 3 pl., 3 figs., 1946.

In a series of experiments with 34 strains of fungi ascribed to *Phoma* and cognate genera, the author has sought to clarify the confusion arising from the many names applied to pycnidial fungi with colourless, unicellular spores, associated with minor *Phoma* rots of potato, and to remove some of the difficulties occasioned to plant pathologists thereby in determining the causes of these disorders.

Preliminary isolations showed three types of culture, considered to represent distinct species of *Phoma*, commonly obtainable from British potato tubers, all being non-aggressive parasites, possibly soil-inhabiting and not specialized to any particular host. A collection of *Phoma* species was made during 1944 from herbaceous plants in south-east Scotland to compare with these. Morphological, cultural, and physiological characters and degree of pathogenicity were employed as criteria in classifying the 34 isolates into 17 groups, the nomenclature adopted being that of Grove [*R.A.M.*, xv, p. 53]. Potato tubers (Doon Star), swede roots, tomato stems, tomatoes, and apples (Ben's Red) were used for inoculation.

Group I, referred to *P. foveata*, contained only one strain [ibid., xx, p. 91], although the spore measurements are somewhat larger. This strain caused button-like or small gangrene lesions on Doon Star tubers.

Of the nine strains used to constitute Group II, isolated from potato and a variety of wild plants, some are at present classifiable as *Phoma* or *Phyllosticta* and others as *Diplodina* or *Ascochyta* on the basis of spore septation, but otherwise they appear to be closely related, forming a natural group. All these strains produced similar localized lesions on swede roots, all attacked apples, some locally, but others produced a slow brown rot, and all caused rapid rot of green tomatoes and stem canker, lethal with six strains. Group II is differentiated from *Diplodina* [*Didymella*] *lycopersici* by the appearance of the cultural mat, the presence of stilboid bodies in the latter, and the different reaction on potato tubers, and while strains of group II can attack healthy leaves of young and vigorous tomato plants, they are much less aggressive than *D. lycopersici*, infection by which the tomato is unable to localize. Strain 2 is thought to represent *Phoma tuberosa*, strain 3 *P. solanicola*, strains 4 and 5 and possibly 6 may be Saccardo's *P. herbarum*, strain 7 *Diplodina sonchi*, strain 10 *Phyllosticta lonicerae*, while 8 and 9 suggest the pathogen described by Pethybridge *et al.* [ibid., i, p. 175] as responsible for a 'foot rot' of flax in Ireland and best accord with the description of *Ascochyta linicola* Naoumov & Vassilievski.

Group III was represented by strain 11 only, isolated from a tomato stem and identified as *Didymella lycopersici*. It readily attacked potato tubers [ibid., xxiv, p. 90] and liquefied gelatine to a depth of 5 and 16 mm. in 15 and 30 days, respectively. No pycnidia matured in agar cultures but developed readily on sterilized potato plugs and on inoculated tomato stems. Septation occurred in about 24 per cent. of the spores. The writer was not able to obtain an authentic strain of *Phoma destructiva* for comparison.

Group IV contains one strain only, from living ivy leaves. Strain 13 (group V) formed lesions on Doon Star tubers and apples and it rotted green tomatoes. It

appears to conform most closely to the description by Wollenweber and Hochapfel [ibid., xvi, p. 105] of *P. aceris-negundinis*. Strain 16 from living gooseberry leaves in group VI is classed as *Phyllosticta grossulariae*, and 14 and 15 are considered to be identical with it. Groups VI, VII, VIII, IX, and X were non-parasitic to all experimental hosts, except that strains 17 and 18 (group VII) developed minute lesions on apple fruit. Strain 18 has been identified as *Phoma eupyrena*. Strain 19, the only representative of group VIII, is referred to *P. complanata*; strain 20 of group IX is *P. acuta*, and the remaining strains of this group, nos. 21 to 24, are closely allied to it, all being widespread on dead herbaceous stems. Strain 26 of group X was accepted by Grimes [ibid., xii, p. 24] as probably *P. hibernica*, yet is very like Grove's material of *P. oleracea*, while 25 seems to be *P. urticae*. Strain 28, group XI, is *P. nebulosa*, found on the upper part of dead nettle (*Urtica dioica*) stems, and usually side by side with *P. urticae*. Strain 29, group XII, isolated from a dead figwort (*Scrophularia*) stem, is a form of *P. oleracea* [*P. lingam*], and strain 30, group XIII, bore some resemblance to strain 29 recorded by Grove as *P. oleracea* var. *scrophulariae*. Strain 31 from goosegrass (*Galium aparine*), constituting group XIV, is probably identical with *Diplodina galii*, collected by Grove on *G. mollugo* in Cornwall. It produced on apples lesions only, no rot. Group XV (strain 32) from a pycnidium on a gooseberry twig had the smallest spores of all the strains investigated, produced small lesions on apples, and is identical with Grove's fungus *Ascochytella grossulariae*. Strain 33, group XVI, obviously a form of *P. lingam*, produced a rapid rot of swede, and strain 34, group XVII, Brooks and Searle's original isolation of *P. alternariacearum*, is, according to Wollenweber and Hochapfel, a synonym of *P. glomerata*.

The author found the delimitation, suggested by Wollenweber and Hochapfel, as *Phoma* species those with less than 5 per cent. septate spores and as *Ascochyta* those with more than 50 per cent., difficult to follow in practice, many strains, groups II and III in particular, being intermediate forms. While, however, the confusion of nomenclature as shown by this study exists and the species are so little known no more logical classification can be attempted.

HUGHES (S. J.). **An undescribed species of Chaetomium, with four-spored asci.**—*Trans. Brit. mycol. Soc.*, xxix, 1–2, pp. 70–73, 1 fig., 1946.

A species of *Chaetomium*, differing from *C. hispidum* Fries in not possessing scattered, rigid, divergent hairs, clavate asci, or ovate, yellowish spores, is named *Chaetomium tetrasporum* n. sp. Its distinctive features are the four-spored asci and the numerous small coils comprising the head.

GERSTEL (D. U.). **Inheritance in Nicotiana tabacum. XXI. The mechanism of chromosome substitution.**—*Genetics*, xxxi, 4, pp. 421–427, 1946.

In 1938 Holmes succeeded in substituting a chromosome from *Nicotiana glutinosa*, carrying the factor or factors of resistance to the tobacco mosaic virus, for one of tobacco by back-crosses for several generations of the amphidiploid to tobacco [*R.A.M.*, xvi, p. 417; xvii, p. 417; xxiv, p. 477] and thus produced the resistant Samsoun tobacco. In an investigation of the circumstances permitting such a substitution the author has shown that a similar substitution for a chromosome of the white Cuba tobacco occurred during meiosis in the pentaploid *N. tabacum-N. tabacum-N. glutinosa* parent.

GIGANTE (R.). **L'incurvamento apicale del Pomodoro.** [Apical curving of Tomato.] —*Boll. Staz. Pat. veg. Roma*, N.S., xx, 3, pp. 231–250, 1 pl., 10 figs., 1940. [Received June, 1946.]

In the spring of 1940, Cassalino tomatoes growing in an experimental field near Rome were observed to show a conspicuous downward curving of the stalks and

midribs of the leaves and leaflets on the upper part of the stem. The affected leaves were slightly thicker than healthy ones, rigid, tough, and brittle. The fruits appeared to be normal, but were rather fewer than on healthy plants, and showed a tendency to crack. No fungus or bacterium was present, and there was no sign of insect attack.

Stem and leaf inoculations either by injection or by rubbing gave rise to the original symptoms in ten days to three weeks. Inoculations of healthy tobacco and eggplants by rubbing the leaves with juice from infected tomato plants gave rise to local lesions in the forms of ringed spots in tobacco and in eggplants to minute spots which enlarged, became confluent, and formed circular, polygonal, or irregular necrotic areas.

Histological studies showed the presence of X-bodies in the cells of both the affected tomato leaves and the inoculated tobacco leaves; inoculated eggplant leaves showed a very simple necrosis.

It is concluded that the condition described on tomato plants is due to a virus or viruses producing on tomato, tobacco, and eggplant symptoms differing from those caused by the tomato viruses known at the time of writing.

Banga (O.). **Een vergelijking van het voor meeldauw onvatbare Tomatenras 'Vetomold' met enkele Nederlandsche rassen van Kastomaten.** [A comparison of the mildew-immune Tomato variety 'Vetomold' with some Dutch glasshouse Tomato varieties.]—*Meded. TuinbVoorlicht. Dienst* 24, 40 pp., 21 figs., 4 graphs, 1941. [Received 1945.]

A full account is given of the comparative trials carried out in three Dutch experimental gardens with the Vetomold tomato, immune from leaf mould [*Cladosporium fulvum*] [*R.A.M.*, xxi, p. 172 *et passim*], and 11 varieties widely cultivated in Holland. Vetomold approximates in growth habit and fruit shape to Tuckswood and Potentate, neither of which produces a large number of grade A fruits; the immune variety is slightly inferior in this respect. At Wageningen the yield of Vetomold averaged about the same (2·8 kg. per plant) as that of all the other varieties except the heavy-cropping Ailsa Craig (3·4 kg.). At Naaldwijk, however, the yield of Vetomold was very low (1·4 kg. per plant). As regards earliness, Vetomold was more or less on a level with Radio, Tuckstir, Potentate, Ailsa Craig, Eminent, and Westlandia, the first 10 kg. of fruits on a plot of 32 plants being harvested 105 days after planting out, as compared with 95 to 97 for the four most precocious varieties. Leaf mould did not develop on Vetomold in any of the three localities, even when spore suspensions of *C. fulvum* were applied to the plants.

All things considered, Vetomold cannot yet compete with the leading Dutch glasshouse tomatoes, but it should be used as a parent in crosses designed to yield a product capable of a first-rate performance under all conditions. In this connexion the mode of inheritance of immunity from leaf mould [ibid., xii, p. 250; xvi, p. 571] is discussed.

Sibilia (C.). **L'Ulmus pumila e la grafiosi.** [*Ulmus pumila* and graphiosis.]—*Boll. Staz. Pat. veg. Roma*, N.S., xx, 2, pp. 147–149, 1 fig., 1940. [Received June, 1946.]

Up to the time of writing four cases of natural infection of *Ulmus pumila* by *Graphium* [*Ceratostomella*] *ulmi* [*R.A.M.*, xix, p. 124] had been recorded, two in Holland [ibid., xiii, p. 549], and two in Italy [ibid., xvi, p. 353]. In July, 1939, from a four- to five-year-old *U. pumila* tree at Florence with one withered branch, and the current year's wood showing characteristic blackening, repeated isolations gave the mycelium of *C. ulmi*, with coremia. As this variety of elm is reproduced by seed, occasional variation in resistance is only to be expected, and no uneasiness need be felt on this score.

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HOPKINS (J. C. F.). **Notes on Alternaria (brown) leaf spot of Tobacco.**—*Rhod. agric. J.*, xliii, 2, pp. 114–116, 1 pl., 1946.

The designation '*Alternaria*' [*R.A.M.*, xxiii, p. 483] has become a synonym in Rhodesia for bad tobacco, and although much of this poor-quality tobacco comes from soil on which leaf spot frequently develops, it usually shows no trace of the disease. Tobacco attacked by *A. longipes* shows a leaf spot differing from wildfire [*Pseudomonas tabacum*] in having a bright canary-yellow halo, preceded by a small brown spot, whereas wildfire spots start with a greenish-yellow halo, in the centre of which a light brown spot develops subsequently. Early diagnosis of the *Alternaria* disease is of the first importance. Harvesting of all leaves directly the earliest stages of spotting are noticed is imperative; field dusting and spraying should follow immediately. Two applications of dust or spray with an early reaping, where primary infection has just begun, have proved effective. Failure to strip leaves as soon as the disease is noticed will almost certainly result in the infection becoming epiphytotic in the course of a few days, especially in wet weather, and the crop being lost.

Experiments now proceeding may throw light on the effect of time of planting and type of fertilizer on the incidence of *Alternaria* leaf spot. Meanwhile it is fairly certain that tobacco grown on second- or third-year land is more susceptible than that grown on virgin soil or newly opened fallow and that early plantings, particularly on old soils, are likely to become severely infected. New land, therefore, should be planted early and old land late. The crop is most susceptible to damage when topping time coincides with a long spell of wet weather. It appears that susceptibility or resistance in plants is conditioned by the nitrogen balance within them. Leaves attacked by *A. longipes* are usually large and coarse with a low carbohydrate content, without much 'body' or gummy substances. This is attributed to an excess of nitrogen and mineral deficiency, but reductions in the total application of complete fertilizer in order to reduce the amount of nitrogen is not recommended as it leads to the production of bodiless leaf which scorches during curing. It is this sort of tobacco which has been dubbed '*Alternaria*' in some districts.

NATTRASS (R. M.) & CICCARONE (A.). **Bacterial canker of Tomatoes in Kenya.**—*E. Afr. agric. J.*, xii, 1, pp. 26–29, 1 pl., 1946.

The first occurrence in Kenya of bacterial canker disease of tomato (*Corynebacterium michiganense*) [*R.A.M.*, xxv, p. 425] was observed near Nairobi in June, 1945, causing almost total loss on a small plot at the Scott Laboratories. Identification of the organism was confirmed by W. J. Dowson. As far as is known this is the first record of this disease in East Africa, nor is it believed to have been recorded from South Africa or Rhodesia. In Kenya its status is not yet known, but the severity of the initial outbreak suggests an ability to cause considerable loss.

After recording the symptoms of the disease the authors express the opinion that most of the primary infections are derived from diseased seed. This was probably the case in the initial outbreak at Nairobi but, as over 80 per cent. of the plants were infected, some may have originated from spread in the seed-bed [cf. ibid., xvii, p. 80]. Secondary infection occurs in wet weather by the scattering in rain drops of the bacterial exudate from the cankers. This causes a superficial infection of the fruit in the form of small, raised spots with white haloes. This is the only type of secondary infection that has been observed in Kenya, and is quite different from the systemic infection.

Fermentation of the pulp for the extraction of seed as recommended by Blood [ibid., xxi, p. 353] gives almost complete control of the seed-borne infection, being more effective than hot water (one hour at 54° C.) or the mercuric chlorine treatment. In a trial at Nairobi the fermenting pulp was kept at 90° F. for four days, and although germination was slow, the percentage was only slightly below that of the freshly extracted seed.

Additional control measures suggested are the use only of sterilized soil, or that which has not grown tomatoes before, for seed-boxes or beds. Plants showing symptoms of *C. michiganense* should be removed and destroyed and should not be put on the compost heap. Diseased plants should be removed before pruning, or suspected plants left until pruning is finished. Frequent sterilization of the hands and of pruning knives should be insisted on. Only seed from plants from a plot inspected and certified free from the disease should be sown; and seeds from an unknown source should be grown in isolation from all other tomato plants until they are recognized to be free from disease.

GOIDÀNICH (G.). **L'Olmo Buisman.** [The Buisman Elm.]—*Boll. Staz. Pat. veg. Roma*, N.S., xxi, 3, pp. 270–286, 11 figs., 1941. [Received June, 1946.]

During 1939, 1940, and 1941, further inoculations of C. Buisman elms with *Graphium* [*Ceratostomella*] *ulmi* in Italy [*R.A.M.*, xxv, p. 528] again demonstrated the resistance of this variety to the disease, whether the trees were grafted on *Ulmus hollandica* or *U. pumila*.

GOIDÀNICH (G.) & AZZAROLI (F.). **Relazione sulle esperienze di selezione di Olmi resistenti alla grafiosi e di inoculazioni artificiali di 'Graphium Ulmi' eseguite nel 1939–1940.** [Report on experiments on the selection of Elms resistant to graphiosis and on artificial inoculations with '*Graphium ulmi*' carried out in 1939–1940.]—*Boll. Staz. Pat. veg. Roma*, N.S., xxi, 3, pp. 287–306, 4 figs., 1941. [Received June, 1946.]

During 1939, 30 pure-line ungrafted *Ulmus pumila* trees were experimentally inoculated with *Graphium* [*Ceratostomella*] *ulmi* [see preceding abstract], some twice, others three times. None of the trees died, but nine developed slight transitory symptoms.

Of 18 *U. campestris* trees which had withstood inoculation in 1938, two withered in June, 1939; the rest were reinoculated in 1939 and of these four developed only slight symptoms of the disease even after two or three inoculations.

In 1938 scions of 19 plants of *U. campestris* selected for their resistance in inoculation experiments were grafted on to *U. pumila* stocks, and in 1939 parallel inoculations were carried out on these and on the parents. Infection on the young grafts was less severe than on the original plants. In 1940 the grafted trees were reinoculated, and on the whole the results were more serious. The variety Villafranca 8, however, appeared normal after four inoculations. Among the *U. campestris* trees selected in 1937, Villagrappa 3 continues to show resistance, even after five inoculations in 1939. Ten plants, produced by grafting this variety on to *U. pumila* stocks

and receiving the same treatment in 1939 and four reinoculations in 1940, showed only slight symptoms.

Borzini (G.). **Sulle cause di un deperimento di piantine di Cipresso.** [On the causes of a wilt of Cypress seedlings.]—*Boll. Staz. Pat. veg. Roma*, N.S., xx, 4, pp. 330–335, 4 figs., 1940. [Received June, 1946.]

In October, 1939, the author received from Tripoli a number of cypress [*Cupressus* sp.] seedlings showing stunted growth as a result of a wilt causing a characteristic curvature of the shoot tips, which showed the presence of the mycelium and spores of an *Alternaria* considered to belong to the *A. tenuis* group. The roots and the rest of the plant appeared to be healthy. On the host the conidia measured 16 to 34 by 6 to 18 μ. In culture they measured 12 to 38 by 6 to 15 μ (greatest frequency 21 to 23 by 9 to 11 μ).

Bier (J. E.) & Foster (R. E.). **Significance of conk rot on Sitka Spruce on Queen Charlotte Islands.**—Reprinted from *B.C. Lumberm., 1946,* May, 3 pp., 3 figs., 1 diag., 1946.

Of the 31 species of fungi contributing to the decay of Sitka spruce [*Picea sitchensis*] on the Queen Charlotte Islands, British Columbia, only *Fomes pini*, the agent of conk rot [*R.A.M.*, xv, p. 694], produced external fruit bodies whereby the internal rot could be recognized. The internal symptoms seldom extend far below the lowermost fructification visible on the trees. *F. pini* was responsible for 40 per cent. of the total loss through rot in the 1,977 trees examined in the course of the writers' investigations. An analysis of the importance of the fungus in relation to degrading of the wood in the 354 affected trees showed that averages of 97·8 and 89·2 per cent. of grades 1 and 2 were free from decay, compared with only 55·4 per cent. in grade 3. Trees with long rows of fruit bodies extending down to a height of 50 to 60 ft. above ground should be felled, since a high proportion of the first- and second-grade wood in the basal log will probably be sound. These observations are applicable exclusively to the disease as it affects *P. sitchensis*, as the causal organism may assume quite a different form in other west-coast species.

Robak (H.). **Nye undersøkelser over muggsoppers innflytelse på fruktlegemedannelsen hos Pholiota mutabilis.** [Further studies on the influence of the mould fungus on fruit body formation by *Pholiota mutabilis*.]—*Nyt Mag. Naturv.*, lxxxi, pp. 105–116, 1 graph, 1941. [English summary. Received September, 1946.]

Further experiments confirmed the results previously described (*Nyt Mag. Naturv.*, lxxvii, pp. 120–128, 1937) of tests in which the inoculation of the beer wort agar medium with *Penicillium expansum* led to the production by *Pholiota mutabilis* [*R.A.M.*, xv, p. 72] of normal fruit bodies, otherwise abortive or lacking. The mould presumably contains vitamins, hormones, or weak toxins which exert a stimulus on sporophore formation.

Van Wyk (J. H.). **Preservation of timber for the farm.**—*Fmg S. Afr.*, xxi, 243, pp. 377–382, 2 figs., 2 diags., 1946.

Timber to be prepared for creosote treatment in South Africa [*R.A.M.*, xxv, p. 378] should be cut from March to April, the bark stripped, the poles stacked in the open, and left to dry through the winter. A moisture content of 20 per cent., reached in four to nine months according to the size and variety of pole, should be retained. Free ventilation should be assured when stacking poles. The treating

plant required should be so constructed as to ensure safe heating of highly inflammable creosote over an open fire. Three plants which can be easily and cheaply constructed are described, and two of them illustrated.

BENNETT (C. W.) & MUNCK (C.). **Yellow wilt of Sugar Beet in Argentina.**—*J. agric. Res.*, lxxiii, 2, pp. 45–64, 8 figs., 1946.

The name 'yellow wilt' is given by the authors to a disease which has attacked sugar beets in the Rio Colorado and Rio Negro valleys of Argentina, probably ever since the industry was introduced there in 1929. In 1938–9 it caused an almost total loss of crop in the Rio Negro valley, and in 1941 sugar beet cultivation in this area was discontinued. There is some evidence that the disease also attacks garden beet and Swiss chard.

There are two phases of the disease. The first begins with yellowing and in two months most of the plants are stunted and yellow, conspicuously so along the veins. The leaves become thickened, brittle, and rolled, with some marginal and intervenal scorching, and assume an erect position. The plants remained in a fair condition, some showing slight growth of axillary buds; the tap-roots, however, were woody and the rootlets mostly dead. The second phase does not appear until the yellows phase is fully evident. Plants attacked at this stage wilt rapidly and usually die within a week. Occasionally growth was renewed with thick, folded, greenish-yellow leaves tinged with purple. The rootlets die at an early stage and the main root withers later.

Under greenhouse conditions the disease was induced by grafting diseased to healthy tissue and in a few cases by the dodder species *Cuscuta subinclusa* and *C. campestris* [cf. *R.A.M.*, xxiv, p. 136], but not by juice inoculation. The disease induced was always the yellows, never the wilt type. The leafhopper *Atanus exitiosus* is considered to be the vector of the causal agent. All field beet plants protected by insect cages remained healthy.

It appears, therefore, that there exists in this part of Argentina a virus which does little or no damage to native plants, but is dangerously pathogenic to imported sugar beet varieties; and even though the beet sugar industry has as yet no great importance there, such a disease must be regarded as of serious significance lest it should be introduced into other beet sugar-producing countries of the world.

HALE (J. B.), WATSON (M[ARION] A.), & HULL (R.). **Some causes of chlorosis and necrosis of Sugar-Beet foliage.**—*Ann. appl. Biol.*, xxxiii, 1, pp. 13–28, 2 pl., 1 graph, 1946.

This paper reviews the symptoms of common diseases of sugar beet due to beet yellows virus, beet mosaic virus, a secondary complication of downy mildew (*Peronospora schachtii*), magnesium, manganese, and potash deficiency, and the toxic effect of excess manganese, and describes the chemical, phytopathological, and field methods which have been employed to distinguish between them, notably in the practical diagnosis of atypical conditions and those complicated by the presence of two or more diseases. The material used came from field crops grown in eastern England. Virus tests were made by sap inoculation, aphid transmission, or serological methods, and mineral deficiency examined spectrographically. In deficiency tests, either the soil was amended with the element presumed to be deficient, or it was sprayed on to the plants, or injected into them by Roach's method.

Beet mosaic, though very common and usually found where seed crops are grown [*R.A.M.*, xxiv, p. 84], corresponds in distribution and frequency with beet yellows virus and both are transmitted by the aphids, *Myzus persicae* and *Aphis fabae*. It has little importance in Britain, but should be regarded as a distinct disease, unassociated with nutrient deficiency or beet yellows virus.

Beet yellows virus [ibid., xxii, p. 123] is a source of serious economic loss in sugar beet in Britain and the primary foliar symptoms of vein-clearing and superficial etch-like necrosis, followed by bright or orange-yellow, intervenal and basipetal chlorosis, with golden-brown necrotic tissue particularly at the margin and tip, may be accompanied by a secondary infection by *Sporodesmium* spp. Bright scarlet spotting in some varieties is considered diagnostic. The distribution and frequency of the disease depend on the behaviour of the aphid vectors and the presence of overwintering sources of the virus [ibid., xxv, pp. 135, 245]. Analyses made in 1942 showed that the magnesium content was consistently higher in infected than in healthy plants, and the differences varied with the degree and date of infection. In early-sown plants the magnesium content of infected specimens was 0·62 as compared with 0·48 per cent. in healthy plants, and for late-sown beet 0·72 and 0·48 per cent., respectively.

Downy mildew parasitizes chiefly seed and young root crops and the symptoms can be distinguished from virus yellows by the presence of vascular lesions in the veins or petioles, with the collapse of the xylem vessels, which become dark purple-brown, often visible through the superficial tissues. The lower leaf surface may have sticky, purplish lesions. The disease attacks seed crops more than virus yellows.

The chlorosis caused by magnesium deficiency is paler, the leaf surface more glossy, the demarcation between yellow and green more pronounced, the tissues less brittle, and the necrosis darker brown than in the case of yellows virus, but laboratory technique may be required for confident diagnosis in advanced cases. A comparative leaf analysis of plants treated by spraying or injection with magnesium sulphate offered little evidence that amendments with magnesium salts will reduce the chlorotic symptoms invariably associated with low magnesium content of the leaves, which may be due to several interacting factors. It is suggested that calcium may be required to control this condition. In all manurial experiments addition of agricultural salt [sodium chloride] increased magnesium deficiency symptoms.

The generally accepted symptoms of potash deficiency are apical and marginal necrosis and a dull, olive-green appearance of the leaf, which afford a striking contrast with those of yellows and magnesium deficiency, when all three disorders may be encountered at the same time of year, late in the summer. The results of experiments show that this condition can occur not only as a consequence of low potassium content of the plants, but also when the sodium content is low, even though that of potassium is high. The general conclusion is that the sugar beet plant can suffer from sodium deficiency, which may be accompanied to some extent by potash deficiency. The symptoms can be reduced by either element applied separately. The use of sodium invariably conferred a greater increase of crop dry matter per acre, and must be held to contribute to the amendment of a sodium shortage.

The chlorotic mottling in the intervenal areas of the leaf laminae, characteristic of primary symptoms of manganese deficiency (speckled yellows) [ibid., xviii, p. 266], is readily distinguishable from other chlorotic beet diseases. These lesions develop in May and June and form a feathery pattern of pale white-green, later developing into translucent, pinkish-buff, necrotic patches, of a horny texture, becoming more diffuse when the plants are beginning to recover, and rendering the condition less easily distinguishable from other chlorotic beet disorders. Experiments showed that it can be eliminated by spraying or injecting with manganese sulphate and reduced by soil applications of ammonium sulphate, potash, and salt, all of which increase the manganese content of the leaves.

A chlorosis of uniform pale yellowish-green, accompanied by stunting, upright habit, and marginal inrolling, was associated with excess of manganese in plants growing on soils with a pH value usually below 5, analysis showing that the

concentration of manganese was 10 to 30 times the average, while the calcium content was slightly higher than normal.

HADORN (C.). **Bohnenkrankheiten und Bekämpfungsversuche mit Saatbeizmitteln.** [Bean diseases and control experiments with seed disinfectants.]—*Forsch-Ergebn. Gartenb., 1944*, 4, pp. 3–33, 22 figs., 1 diag., 2 graphs, 1944. [Received 1945.]

None of the 13 disinfectants tested against the three chief seed-borne diseases of beans [*Phaseolus vulgaris*], anthracnose (*Gloeosporium* [*Colletotrichum*] *lindemuthianum*), grease spot (*Pseudomonas* [*Xanthomonas*] *phaseoli*), and leaf spot (*Ascochyta pisi*) at the Federal Experiment Station, Wädenswil, Zürich, gave complete control of the first-named pathogen and all were ineffectual against the bacteriosis. Ceretan [ceresan] dust (0·5 gm. per 100 gm. seed) proved useful in the elimination of *C. lindemuthianum* if applied when the seed coat only was involved, but once the hyphae had penetrated the cotyledonary tissues the outcome of the treatment was questionable, and by the time the deeper layers of the cotyledons were reached further measures were unavailing. The life-history of *A. pisi* is very similar to that of *C. lindemuthianum*.

The most reliable means of combating anthracnose and the bacterioses (in addition to *X. phaseoli*, *Bacterium* [*Corynebacterium*] (?) *flaccumfaciens* has been detected of recent years on the Ohnegleichen and Julibohne varieties) consists in the procurement of sound seed from uninfected pods, preferably from entirely healthy plantings; where the strict observance of the last-named precaution is impracticable, the pods at any rate must be disease-free. In suspicious or doubtful cases thorough sorting of the seeds, discarding any spotted ones, should precede treatment with a mercury-containing fungicide. Anthracnose, the bacterioses, *A. pisi*, and bean rust (*Uromyces appendiculatus*) can be more or less effectively held in check by two or three timely applications of a copper mixture with good adhesive properties, e.g., Bordeaux or copper-Sandoz to prevent stem and leaf infections, while the pods of crops grown for seed should be protected by two further treatments in July or August.

The ravages of anthracnose may be materially reduced by rational cultural measures. In Schaffnit and Böning's monograph on bean anthracnose [*R.A.M.*, iv, p. 456] mention is made of the favourable effects of potash and phosphorus on plant structure, the loose foliar system resulting from these elements in the soil affording ready access to sun and air, to which the site should be well exposed. Plant residues should be collected and burnt after harvesting, crop rotation practised, and the supports disinfected with 5 per cent. carbolineum after picking or at latest three weeks before further use, chiefly to destroy the resting spores of *U. appendiculatus*.

BLODGETT (E. C.). **Observations on blasting of Onion seed heads in Idaho.**—*Plant Dis. Reptr*, xxx, 3, pp. 77–81, 1946. [Mimeographed.]

Onion seed production is stated to have increased rapidly of recent years in south-western Idaho, but in many cases the yield has been drastically reduced by 'blasting' of the flowers after apparently normal bloom, resulting in their partial or total failure to fill out and set seed. Where two or more seed stalks arise from the same bulb, one or more of the heads may be perfectly filled out while the others are slightly or severely damaged. Some of the affected heads were found to be borne on stalks with pale, cankered lesions from which *Botrytis allii* [*R.A.M.*, xviii, p. 431] was consistently isolated. Although no inoculation experiments were carried out, the fungus on the stalks is believed to have been directly responsible for the injury to the heads. Onions raised from the same stock as that so heavily attacked by blasting in 1944 were virtually unaffected in 1945.

Biraghi (A.). **Damage apparently caused by Sclerotinia observed on salad crops in Italy.**—*Int. Bull. Pl. Prot.*, xviii, 7–8, pp. 49m–53m, 1944. [Received July, 1946.]

During 1941 and 1942 salad crops [? lettuces] of the varieties Trocadero and Incappucciata riccia growing at Barletta, Francavilla a Mare, and Pescara, on the Adriatic coast of Italy, showed severe collar rot, plants in advanced stages of rot invariably yielding *Sclerotinia sclerotiorum* [*R.A.M.*, xvii, p. 369; xxiv, pp. 2, 350] sometimes accompanied by *S. minor* [ibid., xix, p. 320]. *Botrytis vulgaris* [*B. cinerea*] was occasionally present on the shrivelled leaves as a grey-brown mould. The rot was present over a wide area in which conditions were very varied and the affected plants were usually scattered about in small groups, or isolated among healthy plants which did not contract the disease even when touching the diseased ones. During the early stages of infection, when the aerial parts showed withering or yellowing of the first basal leaves, no causal organism could be detected by isolation or by microscopic examination, but sections of the root at or below the collar showed the presence of yellowish-brown or purplish spots localized in the vascular tissue, the conducting elements of which were filled with gum. The damage was evidently due primarily to cold, and affected plants invariably succumbed to *Sclerotinia* later. It is recommended that a variety having a greater resistance to cold should be found. Meantime, the ground should be covered with straw or similar litter.

Biraghi (A.). **Un marciume della Lattuga prodotto da 'Pythium'.** [A Lettuce rot caused by '*Pythium*'.]—*Boll. Staz. Pat. veg. Roma*, N.S., xx, 2, pp. 119–124, 1 pl., 1 fig., 1940. [Received June, 1946.]

From the cortical tissues of the rotted primary roots of severely wilted lettuces which showed no tissue disorganization or any parasitic organism in the aerial parts, the author isolated a species of *Pythium*, inoculations with which into wounded and unwounded leaf bases of lettuces gave positive results, the fungus being re-isolated from the primary roots of the inoculated plants. In culture on various media the organism formed numerous spherical, rarely ellipsoidal terminal sporangia measuring 18 to 40 (mostly 30 to 32) μ in diameter. The oospores were 13 to 16 μ in diameter, had a smooth wall 1 to 1·5 μ thick, and almost completely filled the terminal oogonia. The antheridia were cylindrical or slightly club-shaped and monoclinous.

Andersen (E. M.). **Tipburn of Lettuce. Effect of maturity, air and soil temperature and soil moisture tension.**—*Bull. Cornell agric. Exp. Sta.* 829, 14 pp., 2 figs., 10 graphs, 1946.

Experiments are described, the results of which suggest that water deficiency, as shown by high soil moisture tension, is the primary cause of lettuce tipburn, thus confirming the conclusions of Beattie [*R.A.M.*, xx, p. 242] and earlier workers, while diverging from those of Thompson [ibid., vii, p. 422] and others.

Plants of the Imperial 44 variety of Iceberg lettuce were grown on two types of peat soil and tipburn was most severe when the difference between maximum air and maximum soil temperature was greatest. It increased as the moisture content of the soil fell. For any given difference between air and soil temperature tipburn would be most severe when soil temperature was lowest, unless both were so low that water loss from the plant would be low also. The greatest difference between air and soil temperature was noted when cool, damp weather was followed by a sunny, dry period. In such conditions it is thought that water absorption is too low to replace water loss and severe tipburn results.

The results of R. Schmidt (*Rep. N. C. agric. Exp. Sta.* 51, pp. 127–133, 1930), showing that days on which the percentage of tipburn increased noticeably were

always preceded by at least one day with a considerable difference between soil temperature and maximum air temperature, and that when the percentage was low days with small differences between maximum air temperature and maximum soil temperature preceded, are consistent with the results reported here.

HADORN (C.) & SCHÜTZ (F.). **Vergleichende Versuche zur Bekämpfung der Weissfleckenkrankheit der Sellerie.** [Comparative experiments in the control of Celery white spot.]—*ForschErgebn. Gartenb., 1942*, 1, pp. 16–23, 8 figs., 1 diag., 2 graphs, 1942. [Received 1945.]

Cuprenox (1 per cent.) was the most effective of the five copper-containing preparations tested against celery blight (*Septoria apii*) at the Wädenswil (Zürich) Experiment Station in 1940 [*R.A.M.*, xxiii, p. 90], raising the total weight of the heads from 32·7 kg. per plot of 6·35 by 1·17 m. to 140·2 kg., the corresponding weights for cupromaag, virikupfer, kukaka, and ropil being 117·7, 114·4, 96·5, and 85 kg., respectively. The outlay on cuprenox of Fr. 2·05 per 100 l., compared with Fr. 1·50 each for kukaka and virikupfer and Fr. 1·70 for cupromaag, is more than offset by the increased yield.

WAHLIN (B.). **Trollsmör i Gurkhus.** ['Fairy butter' in the Cucumber house.] —*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1946*, 2, pp. 28–29, 1 fig., 1946.

A very unusual fungal infection of cucumbers was reported in May 1946 from a market-garden near Linköping, Sweden, where the so-called 'fairy butter' (*Fuligo* sp.), originating in the stable manure of the hot-bed, had enveloped the bases of the fruits and even the lowest leaves. The growth of the plasmodium advanced 15 cm. along a cucumber stem in nine hours, besides attaining a massive volume. Although not actually parasitic, the slime mould assumed a very troublesome form, destroying several fruits before it was arrested by spraying the soil surface with 1 per cent. basic Bordeaux or 0·02 per cent. uspulun.

WAGER (V. A.). **Egg-plants resistant to bacterial wilt.**—*Fmg S. Afr.*, xxi, 243, pp. 410–412, 2 figs., 1946.

The Kopek variety of eggplant continues to show higher resistance to *Bacterium* [*Xanthomonas*] *solanacearum* than the Matale variety [*R.A.M.*, xxiv, p. 49]. These two varieties have been crossed with one another, and each with the variety Terong Gewok of Javanese origin and almost immune from wilt, but whose small, round fruits are useless. The F_3 progeny are highly promising.

MILLER (L. I.). **Peanut leafspot and leafhopper control.**—*Bull. Va agric. Exp. Sta.* 338, 24 pp., 7 figs., 1942. [Received July, 1946.]

The Virginian groundnut crop ranks fourth in quantity of production in the southern United States. The control of leaf spot (*Cercospora* spp.) [*C. arachidicola* and *C. personata*: *R.A.M.*, xxv, p. 58], the most common and destructive disease, is of great importance to local growers, and the results of the experiments reported in this paper show that three or four treatments with finely ground sulphur dust at fortnightly intervals will control both the *Cercospora* leaf infection [ibid., xxv, p. 333] and the leafhopper (*Empoasca fabae*) pest, which causes spasmodic damage. The inclusive cost of the treatment is about $3 per acre.

Three applications of sulphur dust at fortnightly intervals on 30 farms increased the average yield of groundnuts by 481 lb. per acre (range from 238 to 834 lb.). Tests on seven farms yielded increases in hay ranging from 526 to 3,419 lb. per acre. The nuts and hay of sulphur-dusted plants were of better quality, also they

mature some five to ten days later than untreated plants, and can be held in the ground longer without risk of serious loss through shedding, which is a distinct advantage where labour is short at harvesting-time.

MALIK (R. P.). **Collar rot of Pigeon Pea caused by Pythium aphanidermatum (Edson) Fitz.**—*Indian J. agric. Sci.*, xv, 2, pp. 92–93, 1945.

Isolations made at the Imperial Agricultural Research Institute, New Delhi, in 1943 from wilted pigeon pea (*Cajanus cajan*) plants of the U.P. 132 variety yielded a species of *Pythium*, *Macrophomina phaseoli*, a *Fusarium* distinct from *F. udum*, and *Corticium rolfsii* [*R.A.M.*, xxii, p. 154]. On potato dextrose agar the *Pythium* formed oogonia measuring 14 to 34 (mean 21) μ and oospores 12 to 29 (17), while the corresponding means for *P. butleri* and *P. aphanidermatum*, regarded as identical by Carpenter (*Bull. Hawaii Sug. Ass.*, Bot. Ser., iii, 1, 1921) and Mitra and Subramanian [*R.A.M.*, vii, p. 488], are given by Drechsler [ibid., xiii, p. 399] as 27 and 22·5 and 22 and 17·5 μ, respectively. The author's isolate is accordingly referred to *P. aphanidermatum*. Inoculations with the fungus on pigeon pea stems just above soil-level a few days after sowing caused desiccation of the foliage and young shoots, and in some plants of the collar region also.

STAEHELIN (M.). **Sklerotienkrankheit bei Zichorie.** [Sclerotial disease of Chicory.] —*ForschErgebn. Gartenb.*, *1942*, 1, p. 15, 1942. [Received 1945.]

Good control of the chicory wilt and soft rot caused by *Sclerotinia sclerotiorum* [*R.A.M.*, xvii, p. 293] and *S. minor* was secured in extensive plantings at Lausanne by the use of a well-balanced fertilizer with potash and phosphorus as the predominant constituents, nitrogen and organic manures being inadvisable. Both fungi are perpetuated from year to year exclusively by means of their sclerotia, which develop into mycelia under favourable moisture and temperature conditions and infect the roots of the new crop. Soil disinfection with formalin or mercury dusts and by steam sterilization have given good results. The disease is not seed-borne.

VENEZIA (M.) & RUI (D.). **Contributo sperimentale all' economia dell' impiego del rame in viticoltura. Sulle relazioni tra stato di combinazione del rame e sua attività biologica.** [An experimental contribution to effecting economy in the use of copper in viticulture. On the relations between the state of combination of the copper and its biological activity.]—*Boll. Staz. Pat. veg. Roma*, N.S., xxii, 2, pp. 87–118, 1942. [Received June, 1946.]

Microscopic observations on the germination of *Alternaria tenuis* spores treated with various materials in a variety of dilutions and at a range of pH values intended for use against *Plasmopara viticola* [see next abstracts] and containing only small amounts of copper showed that Burgundy mixture containing 1 per cent. copper was more active in preventing germination than Bordeaux mixture at the same concentration (pH 7·85 to 7·9). Bordeaux mixture 1 per cent. at 1 in 500,000 allowed germination, with the production of short promycelia, while Burgundy mixture permitted only incipient germination, and not of all the conidia. Three different types of products, all containing about 8 per cent. copper, showed different anti-germination activity of the copper ion. At 1 in 250,000, ramital [Casale's mixture: *R.A.M.*, xxv, p. 492] (cupro-organic) allowed incomplete germination, with very short promycelia, cupramina (cuprammonia) [ibid xxii, p. 287] permitted germination of some conidia with short promycelia, and Bordeaux failed almost completely to prevent germination with long promycelia. S.V. 4ª (copper bentonite) containing 1·64 per cent. copper was as active at 1 in 50,000 as a product containing a much higher proportion of copper.

BORZINI (G.). **Considerazioni sulle poltiglie a rame ridotto diffuse nella campagna antiperonosporica 1942.** [Considerations on sprays containing reduced amounts of copper released for the campaign against Vine mildew, 1942.]—*Boll. Staz. Pat. veg. Roma*, N.S., xxi, 4, pp. 313–317, 1941. [Received June, 1946.]

The sprays containing reduced amounts of copper for use against vine mildew [*Plasmopara viticola*], the release of which was officially authorized in Italy during 1942, viz., ramital [Casale's mixture], cupramina, and ramato P1, had all been previously tested under official control in every part of the country, ramital for three years. All, particularly ramital, had shown themselves capable of affording the vines adequate protection, though containing appreciably smaller proportions of copper than ordinary Bordeaux mixture.

BORZINI (G.). **Contributo allo studio di metodi pratici di analisi biologica e tecnica di anticrittogamici, con particolare riguardo a poltiglie da usarsi nella lotta contro la Peronospora della Vite.** [A contribution to the study of practical methods of the biological and technical analysis of fungicides, with special reference to sprays for use against Vine mildew.]—*Boll. Staz. Pat. veg. Roma*, N.S., xx, 4, pp. 253–299, 4 figs., 1940. [Received June, 1946.]

After a detailed description of the laboratory methods used by him for the preliminary testing of the fungicidal value of spray fluids (particularly of those destined for use against *Plasmopara viticola*), the author concludes that any spray mixture worthy of further consideration should, when tested by his methods, prove to be at least as fungicidal as ordinary Caffaro mixture [*R.A.M.*, i, p. 66; xviii, p. 124], while its residual activity after leaching by rain, etc., should approximate to that of ordinary neutral Bordeaux mixture, and be not less than that of Caffaro mixture. Preliminary laboratory tests can be made, when sporangia of *P. viticola* are not available, on spores of *Alternaria tenuis* [cf. ibid., xxiii, pp. 34, 35]. If the product under examination gives promising results against these two organisms and has adequate adhesive power, the properties of the dried residue should then be examined, particularly as regards its diffusibility in water, and its fungicidal action compared with that of 1 per cent. Caffaro mixture. Finally, its effect upon the host must be tested. If the outcome of all these tests is satisfactory, then the material can be tried in the field or vineyard.

GOIDÀNICH (G.). **La 'sfaldatura' della Vite.** ['Flaking' of the Vine.]—*Boll. Staz. Pat. veg. Roma*, N.S., xx, 3, pp. 213–230, 9 figs., 1940. [Received June, 1946.]

During recent years American vines in nurseries in various localities in Italy have developed a disease which reduces the vitality of the mother plants and also injures the suckers and layers destined for propagation. Milky-white spots appear on the nodes of the branches and suckers and gradually invade and encircle the whole internode. The tissues of the cortex become pulverulent and are easily carried away by wind or rain, while in severe cases the phloem and xylem become affected. On layers and adult vines the disease attacks the roots and collar, and spreads for 3 or 4 cm. along the branches at the base of the stem. In adult plants the flaking-away of the cortical tissues at the collar is very conspicuous, a great deal of detritus being formed.

The condition is due to a parasitic fungus whose mycelium is at first superficial but later spreads into the tissues, causing the disintegration. Isolations from affected material gave a fungus with hyphae either sinuous and narrow measuring 0·7 to 2 (average 1·3) μ in diameter, with few or no visible septa but many clamp-connexions, or mostly rectilinear, measuring 2·5 to 5 (average 3·9) μ in diameter, with visible septa and larger clamp-connexions 5 to 7·5 (average 5·6) μ in diameter. While the perfect stage was not observed, the vegetative stage strongly resembled

Fibrillaria [? *Psathyrella ampelina*: *R.A.M.*, ix, p. 12] in its morphological characters. If the fungus is later found definitely to belong to this genus, its parasitic nature will be confirmed.

Cook (M. T.). **Plant viruses and plant diseases. (A historical review.)**—v+204+39 pp., Department of Botany, Louisiana State University, 1946. [Mimeographed.]

This work [cf. *R.A.M.*, xv, p. 108; xvi, p. 485; xviii, p. 197], designed to assist advanced students of viruses and virus diseases, is an historical review in which the author attempts to follow the development of every aspect of the subject up to the present time (1943). Its six chapters deal, respectively, with early work on the subject and the economic importance of virus diseases, theories as to their causes, the nature and properties of plant viruses treated comparatively with tabulated summaries, host reactions both external and internal, transmission, and control. The bibliography extends to 39 pages and a chronological record is appended.

Petri (L.). **Rassegna dei casi fitopatologici osservati nel 1942.** [Review of phytopathological records noted in 1942.]—*Boll. Staz. Pat. veg. Roma*, N.S., xxii, 3–4, pp. 197–244, 1942. [Received June, 1946.]

This report [cf. *R.A.M.*, xxv, p. 493] contains numerous items of phytopathological interest, of which the following may be mentioned. A number of proprietary materials containing little or no copper, tested for use against vine mildew (*Plasmopara viticola*) under field conditions, gave satisfactory results. The experiments showed that the fungicidal activity of copper towards *P. viticola* is sometimes increased by the addition of small amounts of zinc.

Plum leaves from Bolzano showed infection by *Polystigma rubrum* [ibid., xxv, p. 457], and carob (*Ceratonia siliqua*) leaves from Rome attack by *Phyllosticta ceratoniae* [ibid., vii, p. 557]. Lemon branches at Caserta were infected by *Phytomonas* [*Pseudomonas*] *syringae* [ibid., xxii, p. 311].

Leaves of *Quercus ilex* in Rome were infected by *Phyllosticta ilicina.* Chestnut fruits from Rome showed mummification due to infection by *Phoma endogena* [ibid., xviii, p. 572]. Elm leaves from Iesi showed the presence of *Taphrina ulmi* [ibid., xvi, p. 642].

Many cases of wheat foot rot near Rome following cold weather early in May were associated with *Fusarium culmorum. Septoria glumarum* [*S. nodorum*] attacked wheat at Piacenza.

Beans (*Phaseolus vulgaris*) in Rome showed leaf spot due to *Phaeoisariopsis* [*Isariopsis*] *griseola.* Green tomatoes showed an apical rot associated with a bacterium provisionally identified as *Phytobacter* [*Bacterium*] *briosii* [ibid., vii, pp. 9, 491] and species of *Fusarium* and *Penicillium*; as these organisms were present only in cracked fruits, the condition, though usually regarded as due only to physiological causes, is in this case attributed to infection.

Nineteenth Annual Report of the Commonwealth Council for Scientific and Industrial Research for the year ended 30th June, 1945.—164 pp., 1945.

Among the various items not previously noted, from the phytopathological portion of this report from Australia [cf. *R.A.M.*, xxiv, p. 402], 30 per cent. infection by yellow [leaf] dwarf virus disease [ibid., xxi, p. 430] is recorded on tobacco in plots containing over 3,000 plants, grown in an area where the crop had not been cultivated for some eight years. Stunting of plants was common, but the absence of other characteristic symptoms has led to a study of different types of dwarfing, in which further research on control of the insect vector, *Thamnotettix argentata* [ibid., xxi, p. 540], is being made.

In field tests on varietal resistance to potato leaf roll no differences in population found of the aphids, *Myzus persicae* and *Macrosiphum gei*, that suggested their preference for any particular potato variety as a feeding-ground. This suggests that differences in susceptibility are related to the reactions of the plant tissues to inoculation. A range of susceptibility was detected among the Australian varieties commonly produced. Bismarck proved most resistant to, and intolerant of, infection. Infected plants were severely dwarfed and produced so few seed tubers that tuber transmission was considered relatively ineffective.

It is considered that browning of flax [ibid., xxiv, p. 507] is an indication of extra quality, provided that growth conditions, prior to the waterlogging which seems to be necessary for browning development, are favourable. The fact that fibre from fields with browning is one or two grades better is attributed to the good supply of soil water at the critical time for fibre production, and to the arrest of growth and fibre development at what is regarded to be the optimum stage for harvesting flax.

Notwithstanding exceptional drought-created conditions in which tomato spotted wilt was virtually absent, the results of experiments on part of a field plot with a very mild strain of the virus, isolated in pure form by tissue selection on the sensitive indicator host, *Nicotiana atropurpureum*, showed that inoculation conferred protection only for the first few weeks. This was confirmed when the concentration of this mild virus in the juice of greenhouse-grown plants was found to decrease rapidly and almost disappear after some weeks. This virus scarcely affects yield.

Considerable damage in various tomato-growing districts throughout Australia has been caused by *Fusarium* wilt. *F. bulbigenum* var. *lycopersici* was isolated from the plants.

VEITCH (R.). **Report of the Director of Plant Industry (Research).**—*Rep. Dep. Agric. Qd, 1942–43*, pp. 5–9, 1943; *1943–44*, pp. 5–10, 1944. [Received July, 1946.]

The Director's report for 1942–3 [*R.A.M.*, xxii, p. 163] records mosaic disease of Navy bean [*Phaseolus vulgaris*] as fairly widespread in Queensland but serious damage was caused in one crop only, where additional evidence has been offered that the disease is seed-borne. Anthracnose [*Colletotrichum lindemuthianum*], which had been extensive on this crop the previous year, was not observed in 1942–3.

A pathological condition in Epicure beans, somewhat akin to halo blight [*Pseudomonas medicaginis* var. *phaseolicola*], was investigated and inoculation with a suspension of bacteria from the Canadian Wonder variety, infected with that disease, reproduced it in Epicure.

Considerable losses of passion fruit resulted from *Fusarium* wilt disease [cf. ibid., x, p. 394], which occurs most frequently on acid soils. Lime amendments prior to planting apparently had little effect, as the young plants became heavily infected in 1943–4 and the adoption of a long-term rotation is considered now to offer the most practical means of reducing *Fusarium* infection of the soil.

An expansion of the ginger industry at Buderim and Eumundi was unfortunately accompanied by the appearance of an [unspecified] disease affecting the shoots and rhizomes of the plants, which were stunted, turned yellow, and eventually the aerial shoots died, the oldest being the first to succumb. Rhizome decay may vary from a faint, water-soaked discoloration to a wet, slimy rot, which may reduce the rhizome to a shell containing the remains of the vascular tissue. As a result of co-operation between the officers of the Department and the growers, a 'seed'-selection scheme was adopted which resulted in a satisfactory stand for 1943–4.

Late-planted maize in the Brisbane district was severely affected in 1942–3 and 1943–4 by wallaby ear [virus: ibid., xxi, p. 485] and a chlorosis resembling mosaic,

which caused stunting of the plants. The latter disease was successfully transmitted by insects.

Smith (J. H.). **Plant pathological investigations.**—*Rep. Dep. Agric. Qd, 1944–45*, pp. 15–16, 1945.

Among other information of phytopathological interest in this report [see preceding abstract] the following items are noted. *Fusarium* wilt of potatoes [cf. *R.A.M.*, xx, p. 340] caused serious losses in 1944 but was almost absent from the following spring crop. The fungus requires temperature and moisture conditions precisely suited to it and no large-scale attack develops otherwise. Calico disease of potato [? a strain of lucerne mosaic virus] has been recorded for the first time in the Lockyer district.

Two leaf diseases of carrot, *Macrosporium* leaf blight [*Alternaria carotae*] and *Cercospora* leaf spot [*C. apii* var. *carotae*: ibid., xxiv, p. 45; xxv, p. 23] caused considerable damage in the year under review, particularly in wet weather during the cool, winter months.

A tendency of Glen Retreat mandarins in the subcoastal areas to overbear, which can be overcome to some extent by careful pruning in winter and thinning the crop when the trees are carrying fruit, is thought to have some connexion with abnormal behaviour known as 'decline' [ibid., xxv, p. 498] in both young and old trees, when the leaves turn yellow and often curl at the tip; leaf fall and die-back follow. Trees usually recover temporarily if fruiting is prevented for one or two seasons and adequate manuring is given. Faulty nutrition may explain this phenomenon, but fertilizer treatment does not provide a complete solution. Mycorrhizal activity may be a factor: it is thought possible that depletion of the organic matter in the surface soil may be caused by cultural practices which tend also to force the roots downwards, depressing mycorrhizal activity and disturbing the nutrition of the trees in other ways.

At Stanthorpe die-back in apple trees has been increasing. Not only old, but some replanted or newly planted trees have been affected, and serious losses have occurred in seedling trees which have just begun to bear. Trees growing vigorously may be seen alongside others which have succumbed. The cause of the disease remains obscure.

Annual report of the Department of Agriculture, Jamaica, for the year ended 31st March, 1945.—14 pp., 1946.

This report [cf. *R.A.M.*, xxiv, p. 353] records, *inter alia*, a further serious decline in the banana industry due to the prevalence of Panama disease [*Fusarium oxysporum* var. *cubense*], leaf spot [*Mycosphaerella musicola*], and war-time commercial uncertainties, which led to the conversion of many plantations to the production of annual crops. Rehabilitation following the hurricane of August, 1944, was confined to the larger plantations, whereas after previous hurricanes the small growers had always shown the earliest recovery. Spraying against *M. musicola* on large properties requires considerable equipment but then becomes a matter of routine, whereas for the small owner it also involves a burden of additional labour. Neglect of spraying prior to visual evidence of the disease deprives many growers of the full benefit from the expense involved, and leads to discouragement.

In dealing with Panama disease again the small grower, having no fallow or new land or land free of bananas knows, when he replants, that he is likely to lose a high proportion of his crop from this disease, whereas the large grower can replant a portion of his former area with some assurance that his losses will constitute a relatively small percentage of the stand.

Bronze leaf wilt disease of coco-nuts [ibid., xxiv, p. 367] made slight progress east and west of the severely affected region, but apart from a small section to the east

the advance was negligible compared with that of recent years. New reports came from Cousin's Cove in Hanover and from Treasure Beach in South St. Elizabeth, where young palms were affected in an area where coco-nuts had been completely destroyed 80 years previously. No further extension occurred in eastern Trelawny. In continuation of the felling programme over 26,000 trees were destroyed, many of which were in Hanover areas not cleared the previous year.

In the course of experiments on the susceptibility of sugar-cane varieties to mosaic disease, the following were found to be resistant: B. 39229, B. 40100, B. 40102, B. 40105, B. 40108, B. 40116, B. 40164, M. 270, M. 275, Co. 290, Co. 352, Co. 413, Co. 421, Co. 432. The following contracted slight mosaic: B. 4029, B. 4091, B. 4099, B. 40152, Co. 419, Co. 331. Average susceptibility to mosaic was shown by B. 39171, B. 4096, B. 4097, B. 4098, B. 40112, B. 40126, B. 40130, and Co. 299. Highly susceptible were B. 3915, B. 40114, B. 40117, B. 40133, B. 40174, Co. 231, Co. 313, and Co. 360.

Marked outbreaks of eye spot (*Helminthosporium sacchari*), which is favoured by poor soil and humidity, developed on some plantations during the winter, the variety P.O.J. 2878 being very susceptible while B. 34104 may show heavy infection as well. Only ripening cane is attacked and the economic loss caused by this disease is small.

A leaf spot associated with what appears to be a *Phyllosticta* sp. is generally observed on loofahs [*Luffa* sp.], but only certain varieties are seriously affected.

The following diseases were recorded for the first time in Jamaica: *Cercospora calotropidis* causing leaf spot of *Calotropis procera* [ibid., xi, p. 719]; maize stalk rot (*Pythium aphanidermatum*); cowpea anthracnose (*Colletotrichum capsici*) [ibid., xxi, p. 363]; edua bean (*Stizolobium* [*Mucuna*] sp.) leaf spot (*Cercospora stizolobii*) [cf. ibid., xix, p. 692]; *Cerebella cenchroides* on guinea grass (*Panicum maximum*) inflorescences; jasmine (*Jasminum grandiflorum*) leaf spot (*Cercospora jasminicola*); loofah downy mildew (*Pseudoperonospora cubensis*); oak mildew (*Microsphaera* sp.); and a die-back of guango [*Samania saman*] in certain dry areas on the southern plains in which the trees remained leafless, though the main branches did not die, apparently caused by drought.

Botany and plant pathology section.—*Rep. Ia agric. Exp. Sta., 1941–42*, Part I, pp. 140–158, 4 figs., 1 graph, 1942. [Received July, 1946.]

The following items of interest are not recorded in subsequent reports received earlier [*R.A.M.*, xxiv, p. 356]. H. C. Murphy states that the outbreak of crown rust of oats [*Puccinia coronata*] in 1941 was one of the worst ever recorded in the south-central and Great Lakes States. The disease caused a 30 per cent. reduction in the Iowa oat crop. A survey of oat diseases in the state from 1935 to 1941 shows that *P. coronata*, smuts [*Ustilago avenae* and *U. kolleri*], and *Pythium* [*debaryanum*] root necrosis [ibid., xxv, p. 108] were the sources of most damage. The Boone variety offered considerable resistance to the last-named.

G. Semeniuk and I. E. Melhus report that a species of *Phoma* isolated in early June from onion roots showing pink root rot [*P. terrestris*: ibid., xix, p. 328] was found to be either non-virulent to onion seedlings or mildly so.

Pythium cultures predominantly were obtained early in June from onion crops grown from sets on muck soil in the field, several of the plants showing obvious leaf necrosis from the tips downwards, while the roots remained apparently healthy. The high pathogenicity of most of these isolates to onion seedlings was shown in greenhouse tests in steamed soil. One culture tentatively determined as *P. irregulare* caused 100 per cent. pre-emergence death of Yellow Danvers and Southport White Globe seedlings. *P. debaryanum*, isolated from maize roots, was highly virulent to onion seedlings. Seed treatments gave no protection.

G. C. Kent and I. E. Melhus, in the course of apple-disease studies, showed that

Bacillus amylovorus [*Erwinia amylovora*: ibid., xxiii, p. 26] was unable to utilize nitrogen in the form of nitrates, ammonium salts, or amino acids with glycerine or dextrose as a source of carbon. It is suggested that it may be able to utilize amino nitrogen when the amino acid provides also the source of carbon.

During investigations by I. E. Melhus, J. N. Martin, and H. C. Murphy on the influence of Pythiaceous and other fungi on seedling stands of wheat, barley, rye, flax, lucerne, and cowpeas an experiment was carried out in which these crops were planted in April on an acid Buckner sandy soil, part of which had been treated in the preceding September with 480 lb. chloropicrin per acre [ibid., xxiii, p. 331]. Germination was from 3·5 to 18·8 per cent. (average 12·3 for all crops) better in the treated than in the non-treated soil and stand counts four weeks after planting were from 16·3 to 122·8 per cent. higher on the treated soil. Increases in green weight up to 328·6 per cent. (average 84·97) and in dry weights from 28·6 to 471·2 per cent. (average 204·7) were recorded.

Botany and plant pathology section.—*Rep. Ia agric. Exp. Sta., 1944–45*, Part I, pp. 185–223, 17 figs., 1 map, 1945.

The following subjects of phytopathological interest are mentioned, *inter alia*, in this report [cf. preceding abstract].

I. E. Melhus and C. S. Reddy, with a view to testing resistant strains of melons [*R.A.M.*, xxv, p. 25], released to growers in 1944 Early Resistant Queen, Black Kleckley, Kleckley Hybrid, and Dixie Hybrid seed, extensive plantings of which were made in the spring of 1945.

H. C. Murphy states that root necrosis (caused primarily by *Pythium debaryanum*), crown rust [*Puccinia coronata*], and halo blight [*Pseudomonas coronafaciens*] were in that order the most destructive diseases of oats in Iowa in 1944, root necrosis causing a reduction in yield of 15 per cent., and the other two 3 per cent. The loss from crown rust would have been negligible had it proved possible to plant the whole acreage under oats with the new resistant varieties, Tama, Boone, Control, and Marion. In the collections of crown rust races examined at the Station in 1944, more than usual of those to which Bond is susceptible were identified. This is important in view of the distribution of new varieties, such as Clinton and Benton, inheriting the Bond type of resistance. Mutica Ukrainia [ibid., xxiv, 273], Santa Fe No. 1 [ibid., xxi, p. 184], and Uruguay Landhafer represent first-class sources of resistance to the races of crown rust capable of infecting Bond and Victoria.

Anthracnose of oats [*Colletotrichum graminicola*] was reported for the first time in the State, certain Bond-hybrid selections being apparently the most susceptible.

In comparative experiments set up by I. E. Melhus and C. S. Reddy in the summer of 1944 for assessing the amount of stem rot [*Fusarium batatatis* and *F. hyperoxysporum*] in sweet potatoes grown from vine cuttings and slips [ibid., xxiii, p. 93], vascular discoloration was taken as the criterion of stem-rot infection. Shoemaker variety plants, propagated from slips, showed 18 per cent. infection and those from vine cuttings only 4. The Nancy Gold variety showed little difference (7·9 and 8·3 per cent., respectively, for cuttings and slips) between the two. In 1945 the percentage of stem rot recorded in late June was 0·7 for Shoemaker vine cuttings and 5·9 for slips, and 0 and 0·2, respectively, for Menintico. Nutritional tests with Nancy Hall variety showed an appreciable reduction of stem rot in plots treated with heavy potash and manure dressings.

G. Semeniuk and I. E. Melhus, in the course of studies of pink rot [*Phoma terrestris*], bulb rot *Fusarium* [? *oxysporum*], and other onion diseases, found wide variations in stand counts during seed-treatment tests in the peat soils of northern Iowa.

Bacteria characteristic of *Phytomonas alliicola* were isolated from the necrotic tissues of mature onion bulbs attacked by neck-rot disease during 1943. Onion

plants were successfully inoculated only by hypodermic injections in the necks or the green leaf tissues. In steamed and unsteamed soil the bacteria retained their capacity for infection for over 30 days.

I. E. MELHUS and G. C. KENT report that further experiments on soil treatments with chloropicrin [see preceding abstract] at the rate of 400 lb. per acre showed that oats, wheat, barley, flax, and peas all benefited, particularly through increased root growth, the plants being nearly twice as large as, and much darker green than, those in untreated plots. The treatment had little effect on emergence, but the green weights of peas and flax at harvest were more than doubled and the seed yields of flax and barley considerably increased.

In the report on the testing of new potato hybrids for resistance to tuber and soil-inhabiting pathogens G. C. KENT, C. S. REDDY, I. E. MELHUS, and W. J. HOOKER note that the seedling AOB/4 continues immune from *Phytophthora infestans* but is extremely susceptible to scab [*Actinomyces scabies*]. Some seedlings exhibited a considerable measure of resistance to both, but seedling 46952, though fairly resistant to scab, became a total loss from *P. infestans*.

Hindenburg 627–216 and 528–34 were among the varieties showing the least infection in the 1943 tests. Less scab and higher potato yields followed the growing of rye immediately after digging the 1943 crop than from plots not so intercropped. Autumn ploughing appeared to give better yields and less scab than spring ploughing. Greenhouse tests with pure cultures of *A. scabies* in steamed peat showed that strains from commercially grown red beets are highly virulent to potatoes; that symptoms resembling those caused by *Rhizoctonia* [*Corticium*] *solani* can be induced; and that lesions on aerial parts [of potato plants] and damping-off of lettuce, radish, and other seedlings can be caused. Uniform growth was noted in a pathogenic strain of *A. scabies* only from pH 5·0 to 8·5. In steamed peat at 90 per cent. water-holding capacity and pH 6·5 the optimum growth of *A. scabies* occurred at 30° C., minimum at 0°, and maximum at 35 to 40°.

S. M. DIETZ records the widespread presence of the oak wilt fungus, *Chalara quercina* [ibid. xxiv, p. 79], in Iowa in 1944 and its isolation from *Quercus borealis maxima*, *Q. ellipsoidalis*, *Q. macrocarpa*, and *Q. velutina* in the field and from greenhouse-infected plants of these and *Q. palustris*, *Q. prinus*, *Q. alba*, and *Q. imbricaria*.

H. C. MURPHY, I. J. JOHNSON, and C. S. REDDY found root necrosis (*Pythium graminicola*) and other root diseases mainly responsible for an estimated decline of 60 per cent. in the barley production of Iowa in 1944, and much damage resulted also from *Helminthosporium* spot [? *H. sativum*] and net blotch [*H. teres*]. Observations on 4,248 barley varieties and selections from the Bureau of Plant Industry grown at Ames in 1944 showed that some 200 of these were free from symptoms caused by root diseases. Those which showed the symptoms yielded *Pythium graminicola* and *H. sativum*. Unnamed selections from the crosses Wisconsin 38×Chevron, Velvet×Peatland, and Glabron×Peatland were most resistant to *H. sativum* in greenhouse tests, as were Manchuria and some of its strains and C.T. No. 4447. Many selections from crosses involving Chevron and other varieties resistant to *Erysiphe graminis hordei* showed high resistance.

In the course of his report on studies of soy-bean diseases and their control G. C. KENT states that the bacterial organisms, *Xanthomonas phaseoli* var. *sojense*, causing bacterial pustule, and *Pseudomonas glycines*, the agent of bacterial blight, were destroyed after seven weeks in culture solution at 10° F. in freezing tests, though they tolerated 13 weeks at this temperature when dispersed in steam field soil. Buffered potato dextrose agar is essential for the successful isolation of these pathogens from seed or from any aerial part of the plant. In experiments on seed treatments, using Lincoln of high germinability, only new improved ceresan at ½ oz. per bush gave highly significant increases in stand. At 1 oz. per bush. it was highly injurious.

Report of the Federal Experiment Station in Puerto Rico, 1945.—62 pp., 1946.

In the section of this report [*R.A.M.*, xxiv, p. 495] dealing with plant introduction (p. 34) D. G. White, M. Cobin, and E. P. Hume announce the opening of a rubber (*Hevea brasiliensis*)-breeding garden in co-operation with the United States Bureau of Plant Industry, the eventual lay-out of which is intended to provide the largest number of possible combinations with 12 of the highest-yielding and most disease [*Dothidella ulei*]-resistant Ford-Brazilian clones [ibid., xxiii, p. 455] yet to be added.

P. S. Roboles, Noemi G. Arrillaga, and Merriam A. Jones report no increase in stands of Chinese ginger following fungicidal seed piece treatments to decrease [unspecified] rot.

Wormald (H.). **Physiologic races of the crown gall organism in Britain.**—*Trans. Brit. mycol. Soc.*, xxviii, 3–4, pp. 134–146, 2 pl., 1945.

A tabulated description is presented of inoculation tests and experiments with the crown gall organism (*Bacterium tumefaciens*) carried out during the last 25 years at the East Malling Research Station, using isolates obtained from apple, bramble, dock (*Rumex crispus*), hollyhock, loganberry, raspberry, runner bean [*Phaseolus multiflorus*], and *Schizanthus*. The general conclusion drawn from these studies is that within the species *Bact. tumefaciens* in Britain there are four physiologic races with different host relationships and habit in culture. (1) The daisy (*Chrysanthemum*) type, considered to be apparently similar to the original strain of *Bact. tumefaciens*, readily infecting Paris daisy (*C. frutescens*), produces medium-sized galls on tomato and raspberry, rarely on apple, and gives no definite acid reaction in lactose media. (2) The dock type (including raspberry and probably a loganberry isolate) does not infect Paris daisy but produces large galls on tomato, apple, and raspberry. It gives a marked acid reaction in lactose media (an acid curd in milk). (3) Other isolates are non-pathogenic on Paris daisy and induce small galls on tomato and usually a little acid in purple lactose agar but not in milk. (4) On apple stems isolates of *Bact. tumefaciens* from apple and pear produced only small galls or none at all, and negative results on other hosts inoculated; they developed acid in media containing sugar (sucrose, dextrose, or lactose), and an acid curd in milk cultures.

Tumours apparently of the crown-gall type were also collected at East Malling in the course of these investigations on hops, beetroot, marigold, melon (leaves), *Scolymus*, *Dahlia*, *Phlox*, *Chaerophyllum bulbosum*, *Eucalyptus* sp., lupin, and other plants.

That two of the strains should have been isolated from a common weed (*R. crispus*) and a hedgerow plant (bramble) is thought significant, as such plants may serve as unsuspected hosts of *Bact. tumefaciens*.

Starr (M. P.). **The nutrition of phytopathogenic bacteria. II. The genus Agrobacterium.**—*J. Bact.*, lii, 2, pp. 187–194, 2 graphs, 1946.

Continuing his studies on the nutritional requirements of phytopathogenic bacteria [cf. *R.A.M.*, xxv, p. 292], the writer corroborated previous observations on the capacity for growth in a medium containing ammonium chloride, other inorganic salts, and separately sterilized purified glucose of *Agrobacterium* [*Bacterium*] *radiobacter* [ibid., xx, p. 247], *A.* [*Bact.*] *tumefaciens* [ibid., xxi, p. 130], and *A.* [*Bact.*] *gypsophilae* [ibid., xxv, p. 292]. The failure to develop in this medium of *A.* [*Bact.*] *rhizogenes*, *A.* [*Pseudomonas*] *rubi* [loc. cit.], and *Bact. pseudotsugae* [loc. cit.] was traced to the obligate nutrilite demands of these organisms, biotin and glutamic acid being essential to *Bact. rhizogenes*, biotin, nicotinic acid, calcium pantothenate, and glutamic acid to *Bact. rubi*, and biotin and an as yet undetermined compound

of 'vitamin-free' casein hydrolysate to *Bact. pseudotsugae*. The application of these results to the taxonomy of the group is briefly discussed.

VERONA (O.). **Qualche osservazione sulla fase 'R' di Bact. tumefaciens Smith et Townsend.** [Observations on the 'R' phase of *Bacterium tumefaciens* Smith & Townsend.]—*Ann. Fac. agr. Pisa*, N.S., iv, 19, pp. 525–533, 2 figs., 1941. [French, German, and English summaries. Received August, 1946.]

When a virulent culture of *Bacterium tumefaciens* was grown on meat agar to which lithium chloride, lithium nitrate, or lithium sulphate had been added in amounts containing from 0·05 to 0·5 per cent. of the element, variant strains developed. On plain meat agar the colonies were of the smooth ('S') type [*R.A.M.*, xiv, p. 154], mucose, raised, translucid, semi-transparent, and with a continuous outline, whereas on meat agar plus lithium they were of the rough ('R') type, rugose, dry, flat, and with a sinuous-lobate outline. The S colonies gave marked production of mucus. In peptone broth they produced a slight homogeneous turbidity and formed a thin pellicle. In meat agar plus phenic acid growth took place when 1 per cent. of the acid was present. Suspension was normal in solutions of sodium chloride (0·85 per cent.) and copper sulphate (1 per cent.). No agglutination took place in the presence of tripaflavine 1 per mille. The rough colonies, on the other hand, produced more turbidity in liquid cultures, and formed a ring instead of a pellicle. Little, if any, production of mucus occurred. In meat agar with 1 per mille phenic acid growth was slow, difficult, or lacking. Only slight agglutination took place in solutions of 3·5 per cent. sodium chloride and 1 per cent. copper sulphate, while marked agglutination occurred in the presence of tripaflavine 1 per mille. The rough phase was less markedly Gram-negative than the smooth and was shown by inoculation tests to be much less virulent. The variants on lithium agar were not fixed and when transferred to ordinary meat agar quickly reverted to the smooth phase.

WOODS (M. W.) & DU BUY (H. G.). **Seasonal changes in biological equilibria involving two chondriosomal systems in variegated Hosta.**—*Phytopathology*, xxxvi, 6, pp. 472–478, 2 figs., 1 diag., 1 graph, 1946.

The white, variegated areas in *Hosta japonica* at College Park, Maryland, were shown to arise from the presence of colourless plastids multiplying at rates different from the normal plastids in the heterochondric cells comprising both types [cf. *R.A.M.*, xxiii, p. 163]. In spring- or autumn-formed foliage the variegation-inducing plastids apparently inhibited the reproduction of the normal ones in heterochondric cells, resulting in pronounced variegation, whereas during the heat of summer the symptoms in the successively developing leaves were 'masked'. The vascular leaf tissues influenced the adjacent mesophyll in such a way as to provoke the frequent multiplication of normal plastids at the expense of those responsible for variegation, irrespective of the season.

These relationships are comparable with the interactions between a virus and the chondriosomal system of an infected cell, and since plastids may be considered specialized mitochondria the results suggest affinity to certain animal neoplastic diseases.

VOELCKER (O. J.). **Annual Report West African Cacao Research Institute. April 1945–March 1946.**—58 pp. [1946. Mimeographed.]

The following items of phytopathological interest occur in this comprehensive survey of cacao research in West Africa [cf. *R.A.M.*, xxv, p. 440].

The marked tendency for new strains of virus organisms to be recorded from fresh isolated outbreaks of [cacao swollen shoot] virus disease will, it is hoped, decline with the completion of the Cacao Reconnaissance Survey. Mild strains are

known from the Ivory Coast, the Western and Eastern Provinces of the Gold Coast, Ashanti, and Togoland and are characteristic of the Nigerian outbreaks [ibid., xxv, p. 494]. Virulent strains are concentrated mainly in the Eastern Province of the Gold Coast, with localized centres in Ashanti, the Western Province of the Gold Coast, and the Ivory Coast.

The most noticeable feature of the mild virus infections [ibid., xxv, p. 293 *et passim*] studied is the rarity of dead trees. There is either no sign of virus infection or merely a slight deterioration in the canopy. Leaf symptoms, if present, are mild mosaic, flecking, fine vein-clearing, and 'fern' patterns, while severe chlorosis and crinkling are rare. Swellings are usually prominent. Two new strains, one discovered at Mampong on the Akwapim Ridge and the other in western Ashanti, differ greatly from one another and from all known Gold Coast strains. The Mampong strain is the most infective yet encountered, seedling symptoms appearing about three weeks after budding. The acute symptom, that of yellow veinbanding or sometimes complete yellows, is most prominent on leaves developing immediately above the bud and least on those on the opposite side of the stem. It is mostly confined to one leaf-flush, later ones being healthy except for slight general chlorosis. Large swellings develop later. The Ashanti strain requires about three months to produce, in graft-infected seedlings, symptoms expressed as clear, yellow bands following the primary veins, sometimes with severe crinkling and tearing as the leaf hardens. The leaves are darker green than normal and without any dwarfing. It resembles the strain found in the Yakasse district of the Ivory Coast [loc. cit.] more closely than the Gold Coast strains.

The first series of insect transmissions [ibid., xxiv, p. 307] suggests that virus strain A may represent a complex of at least two strains. *Ferrisiana virgata*, in addition to transmitting the complex, infected seedlings with a strain similar to B. *Pseudococcus njalensis* [ibid., xxv, p. 206] transmitted a strain which caused mosaic but not swellings. Coppicing trials and resistant selection tests suggest the instability of the virulent strain A, which would point either to its complex nature or to ease of attenuation. In either case a knowledge of the relationships between mild and virulent strains is essential for future work. Their relative distribution suggests the derivation, by synthesis or mutation, of the virulent from the mild strains. The elimination of the latter would then become necessary.

The results for 1945–6 of the immunization experiment begun in 1942 show that the mean yields per tree (in pods) were 15·2, 18, 8·3 and 0·2 for uninfected and those infected with strains B, C, and A, respectively, a difference of five pods per tree being statistically significant.

Observations at a site of 8¼ acres of typical mature trees, exposed to attack by strain A, showed that at the beginning in August, 1945, one-third of the trees were infected. By March, 1946, the number of healthy trees was reduced by 10 per cent. The yields (in pods per ¼-acre plot) ranged from 428 where 80 to 100 per cent. of the trees were infected to between 1,229 and 1,405 for 0 to 40 per cent. infection. Rate of spread of the same strain is also shown by records taken in two areas near Osino in the Eastern Province of the Gold Coast, where at Domi some 120 trees were diseased in 1941 and by 1945 about 10 acres were infected, while at Nsutum an outbreak covering 0·05 per acre in 1941 increased to 3·5 in less than five years. On an observation plot at the Unit Farm, Abetima, near Dawa, Krobo, the radial spread of an outbreak due to strain H had in 1942–3 infected, but not killed, five trees, the number of healthy trees being 229. By 1945–6 81·6 per cent. were infected of which 52 were dead.

During the year 8,124 seeds from plants infected with strains A, B, C, BC, or CB, were germinated and none showed signs of virus disease, thus bringing the total of seeds tested up to 17,767.

Observations on the effect of coppicing showed that the survival rate of healthy

trees when coppiced is high; diseased trees, however, mostly die fairly quickly and too many continue a temporary existence for this to constitute an effective method of control.

The continued selection of potentially resistant material has resulted in the segregation of about 20 clones worthy of further investigation of which six appear highly resistant. Selection SS. 167 is infected by a mild virus, possibly an attenuated form of strain A, which has apparently 'immunized' it.

New outbreaks in the original 60 acres at Tafo have occurred at the same rate as during the past four years. With the discovery that young nymphs (1st and 2nd instars) of *P. njalensis* can transmit the virus and are wind-borne, the random and widespread extension of swollen shoot can be attributed to the wind dispersal of the vector. Assuming that the radial spread of outbreaks is stopped if there is no new infection after six months, 17 outbreaks have been controlled completely during the year ending September, 1945, while 30 are still active. Replanting of cacao subsequent to the removal of diseased trees has been accompanied by infection only on a very small scale.

In insect transmission experiments *Toxoptera coffeae* and *Mesohomotoma tessmanni* failed to transmit strains A, B, C, D, and F; while *P. njalensis* and *F. virgata* transmitted strain A (the former infecting four plants out of 20, and the latter nine), but not apparently C or F. Adults, nymphs, and crawlers of *P. njalensis* transmitted strain A after less than four hours' feeding on leaves, shoots, or bark of infected plants. Maximum infection (80 per cent.) followed after feeding on young leaves for 48 hours. Plants infested with vectors four or five days after the hardening of the flush leaves develop virus symptoms most quickly, that is, in 17 days, the shortest incubation period recorded for strain A. *P. njalensis* transmitted strain D to seven out of 20 plants.

Investigations of capsid damage alone and when associated with *Calonectria rigidiuscula* [ibid., xiv, p. 397] showed that the fungus is associated with capsid lesions only on hardened stems. Capsid punctures subsequently infected by the fungus become deep-seated cankers with extensive discoloration of the xylem and toughening of the bark, whereas uninfected punctures show none of these features. The presence of *C. rigidiuscula* is also considered to be associated with the destruction of the older wood in die-back formerly attributed entirely to capsid attack. Hardened shoots half to completely ringed by capsid damage but not infected by the fungus showed no arrested growth, but of those infected nearly half died.

It has been demonstrated by artificial inoculation with pure cultures that *C. rigidiuscula* can be established in healthy wounded cacao trees but its subsequent spread is very slow. If, however, the trees have been weakened by drought or intensive capsid attack invasion is rapid and a conspicuous form of die-back results.

All the three types of *C. rigidiuscula* spores are commonly produced in the Gold Coast. Of the two conidial states (*Fusarium decemcellulare* [loc. cit.]), the microconidia form on the mycelium which sometimes overgrows recently infected tissue, particularly capsid lesions on green stems. The macroconidia are borne on small, emergent, pinkish-buff sporodochia on recently dead stems. Perithecia of the same colour occur in groups on small stromata on stems long dead, and also emerge through cracks in the bark.

MONNIER (P.). **Une nouvelle maladie à virus du Cacaoyer en Afrique occidentale : le swollen shoot.** [A new virus disease of Cacao in West Africa: swollen shoot.]—*Rev. Bot. appl.*, xxvi, 283–284, pp. 166–173, 1946.

After briefly reviewing the history of cacao swollen shoot in West Africa [see preceding and next abstracts], the author describes the symptoms of the disease, its mode of transmission, the losses sustained, and control. Fortunately, not all the forms of the disease found in the Ivory Coast are of a serious nature. No infected

plantation has yet been definitely reported in French Togoland [*R.A.M.*, xxv, p. 441].

MANGENOT (G.), ALIBERT (H.), & BASSET (A). **Sur les caractères du 'swollen-shoot' en Côte-d'Ivoire.** [On the characters of swollen shoot in the Ivory Coast.]—*Rev. Bot. appl.*, xxvi, 283–284, pp. 173–184, 3 pl., 1946.

In this amplified account of swollen-shoot symptoms in cacao trees in different parts of the Ivory Coast [*R.A.M.*, xxv, p. 295 and preceding abstracts] the stem swellings are described as never exceeding twice the diameter of the normal, adjacent segments. The swellings are either solitary, in short chains, or confluent, of varying length, always attenuated at both extremities, and often localized under the necrosed remains of a terminal bud. Histologically, they are characterized by cambial hyperplasia, an excessive development of the wood and phloem, and anomalies of thickening. The characters of the swellings appear to be the same in all parts of the Ivory Coast. In the Kongodia area [ibid., xxv, p. 440], the leaves on affected trees are mostly very small, but curled leaves are rare, although apical necrosis and curving are found. Affected leaves are usually of normal suppleness, though the curved leaves are brittle. A widely varying number of leaves are streaked, as if by mosaic; some areas are normal green, others pale, or yellow, or colourless. At Sankadiokio the diseased leaves are also much reduced in size, but the mosaic is of a different type. The white parts, in which the leaf is rigid and brittle, often appear to develop necrosis. When dried, these leaves turn black. The parts that are green when alive, after drying, become yellowish-green, in contrast to the greyish-green of normal leaves when dried.

RUSSELL (R. C.). **Testing seed for smut spores as an aid in controlling cereal smuts in Saskatchewan.**—*Sci. Agric.*, xxvi, 8, pp. 372–380, 1946.

This paper summarizes the results of six years' tests, by the centrifuge method, of cereal seed-grain for covered smut [*Ustilago hordei*, *U. kolleri*, and *Tilletia caries*] spores [*R.A.M.*, xx, p. 566; xxii, p. 55]. During this time the method has been used commercially for large-scale tests of seed for farmers. The six years' records show that some 80 per cent. of the wheat, 30 of the oats, and 26 of the barley tested were free from smut spores, and thus did not require treatment against covered smuts. At the same time it is pointed out that the presence of other seed-borne organisms, such as *Helminthosporium sativum* [ibid., xxiii, p. 173] and *U. nigra* [loc. cit.], may necessitate seed treatment.

During the last four years seed tested in the commercial laboratory was grown in field plots to compare infection in plants from this seed and in ordinary field crops. The results indicate that it is safe in Saskatchewan to sow untreated seed carrying no more than a trace of smut, as seed in this class never gave more than an average of 0·25 per cent. infected heads, provided that other dangerous seed-borne parasites are not present and that it is of sound quality.

Considerable variation was noted in the amount of smut which develops in crops grown under similar conditions of growth, from seed carrying equal spore-loads of smut. This seems to depend on the variety of the host, the physiologic form of the fungus, the concentration of inoculum, and other factors. In barley and oats, the prime factor may be the extent to which the mycelium has developed under the hulls of the grain [ibid., xix, p. 697].

That *U. hordei* and *U. kolleri* are more prevalent in the black- than in the brown-soil areas of the province may be due to higher moisture in the former favouring mycelial development in the grain. On the other hand, bunt of wheat is more prevalent in the brown-soil zone.

The presence of *U. nigra* complicates the problem of testing barley seed, because most of the loose spores are blown away before the grain is threshed, yet there may

be considerable mycelial development in the seed coat. When infection is suspected seed treatment should be given.

BECKER (HANNA). **Ergebnisse und Erfahrungen bei der Resistenzzüchtung gelbrost-widerstandsfähiger Weizen.** [Results and experiences in the breeding of Wheats for resistance to yellow rust.]—*Z. PflZücht.*, xxiv, pp. 539–568, 1942. [Received August, 1946.]

The general tendency for wheat yellow rust (*Puccinia glumarum*) to decrease in incidence with the continuous elimination, over a period of years, of susceptible plants from identical populations cultivated in different parts of Germany, is deflected by (a) irregular and weak attacks in certain years, and (b) the sudden appearance of new races pathogenic to one or both of the partners used in crosses, e.g., race 9 to Ridit, 27 to Chinese, and 2 to selection 1014 [cf. *R.A.M.*, xiii, pp. 567, 757; xix, p. 77; *et passim*].

The incidence of infection in the field may afford a clue to the dominant or recessive mode of inheritance of resistance, transmission through a recessive factor leading to an unmistakable decline in the infection percentages after two years' selection. It is altogether impracticable, in artificial field infection even with the most scrupulous care, to eradicate every single susceptible plant, as may be seen by the results of subsequent greenhouse inoculations on plants remaining ostensibly resistant in the field, among which there is always a small proportion of homozygous-susceptible individuals. In the case of crosses between a seedling-resistant and a field-resistant parent, the infection percentages in the offspring are higher in greenhouse than in field inoculations. Since the field selection of resistant plants from hybrid populations can never be complete, it should merely serve as a preliminary to the greenhouse inoculations. Selection for field resistance can only be practised from among a field-infected hybrid progeny: the subsequent behaviour of the descendants of individual plants in élite plots in the rust garden will show whether the chosen progenitors were really resistant or not.

The cultivation of hybrid populations in systematic sequence in places liable to yellow rust epidemics in France, Germany, Holland, and Sweden gave disappointing results, neither expediting nor enhancing the dependability of the work of selection. On the other hand, it is important that reputedly resistant varieties or selections should be grown in the maximum possible number of different localities and exposed to the locally prevalent physiologic races, the intensive propagation of which may be effected by the simultaneous cultivation of a 'rust-indicator'.

MINZ (G.). **Yellow berry and stem rust of Wheat.**—*Phytopathology*, xxxvi, 5, pp. 381–383, 1946.

The flinty kernels characteristic of most indigenous durum and imported durum and vulgare wheats under Palestine conditions frequently bear yellow spots. In field trials on the control of wheat stem [black] rust [*Puccinia graminis*] by sulphur-dusting, treated plants were observed to yield only 0·2 per cent. yellow-spotted kernels as against an average of 24 (range 5 to 63) per cent. for the undusted, infected ones. The analysis (by M. Plaut, unpublished data) of kernels from rusted plants revealed a lower weight, lower protein and gluten contents, and inferior gluten and baking quality as compared with those of the sulphur-dusted. The mid-early Florence variety used in the late trials escapes black rust when sown in good time, but late sowings are very susceptible. Late maturity is one of the factors listed by Heald (Introduction to plant pathology, 1943) as influencing the development of yellow berry in the United States [*R.A.M.*, vi, p. 23] and the fact of its control, jointly with that of black rust, by sulphur-dusting indicates that an etiological connexion exists between the two diseases.

CHESTER (K. S.) & PRESTON (D. A.). **Experimental forecast of Wheat leaf rust in Oklahoma for 1946.**—*Plant Dis. Reptr*, xxx, 5, pp. 162–165, 1 graph, 1 map, 1946. [Mimeographed.]

Counts of wheat leaf rust (*Puccinia rubigo-vera* var. *tritici*) [*P. triticina*] pustules in a test field at Stillwater, Oklahoma, at ten-day intervals from 1st February to 1st April, correlated with a survey of the chief wheat regions on 1st April and a study of the weather through the first three months of the year, are used to give a rust forecast sufficiently reliable to help growers to reconsider their crop programmes. In 1946 rust present on 1st April was one-fifteenth of that present in 1945. From this and the weather records it was predicted that it would be an abundant rust year but would probably not reach the epiphytotic proportions of 1945 [*R.A.M.*, xxiv, p. 309].

SIBILIA (C.). **Determinazione di alcune razze fisiologiche italiane di 'Puccinia triticina' Erikss. e di 'Puccinia graminis tritici' Erikss. et Henn.** [The determination of some Italian physiologic races of *Puccinia triticina* Erikss. and *Puccinia graminis tritici* Erikss. et Henn.]—*Boll. Staz. Pat. veg. Roma*, N.S., xxii, 3–4, pp. 193–196, 1942. [Received June, 1946.]

The author reports the discovery in Italy of three new physiologic races of *Puccinia triticina*, referred to as B, R1, and R2, and two of *P. graminis tritici*, a new one, I.G.1, and the locally very prevalent race 40.

BORLAUG (N. E.), HARRAR (J. G.), & STAKMAN (E. C.). **Flag smut of Wheat in Mexico.**—*Phytopathology*, xxxvi, 6, p. 479, 1946.

Flag smut of wheat (*Urocystis tritici*) was observed for the first time in Mexico on 27th April, 1945, distributed over an area of some 10 sq. miles in the Zitacuaro district, State of Michoacán. Circumstantial evidence points to the introduction of the pathogen on wheat imported from Australia [cf. *R.A.M.*, xxiv, p. 308] for milling but inadvertently used in part for seed. A quarantine has been established to prevent the movement of seed wheat from the invaded region to other parts of the country, and a campaign for seed treatment has also been instituted.

TIMONIN (M. I.). **Activity of patulin against Ustilago tritici (Pers.) Jen.**—*Sci. Agric.*, xxvi, 8, pp. 358–368, 1946.

In these experiments to determine the feasibility of using patulin [*R.A.M.*, xxiii, p. 117] obtained from *Penicillium* sp. for the control of loose smut of wheat (*Ustilago tritici*), it was found that at a dilution of 1 in 20,000 patulin reduced the growth *in vitro* of *Ascochyta pinodella*, *A. pisi*, *Epidermophyton floccosum*, *Microsporum lanosum*, *Trichophyton crateriforme*, and *T. gypseum*, and completely inhibited that of *U. tritici* at 1 in 100,000.

The fungistatic and fungicidal activity of patulin against the mycelium of *U. tritici* occurred at the dilutions 1 in 400,000 and 1 in 100,000, respectively. The more resistant chlamydospores required dilutions of 1 in 66,000 in direct contact for complete inhibition of germination or 1 in 20,000 for 24 hours. Patulin proved phytocidal to the wheat embryo when seeds were soaked for 24 hours in 1 in 4,000, 1 in 8,000, and 1 in 20,000 dilutions; moreover it failed to reduce the percentage infection of treated plants and was therefore ineffective for seed treatment.

BLODGETT (E. C.). **Winter injury of fall seeded Wheat in Idaho.**—*Plant Dis. Reptr*, xxx, 4, pp. 106–111, 1 map, 1946. [Mimeographed.]

In eastern Idaho the general opinion of farmers is that winter injury [cf. *R.A.M.*, xxv, p. 496] to autumn-sown wheat is increasing every year. Samples collected by the author and submitted for diagnosis to W. W. Ray, of Stillwater, Oklahoma, showed that, in addition to snow scald (*Typhula* spp.) [ibid., xix, p. 351], the snow

mould fungus (*Calonectria graminicola*) was consistently isolated. In large fields, where the plants showed a mortality of 90 per cent. in 40- to 50-acre patches, either or both diseases were present and the symptomatological differences between them made diagnosis easy. *Typhula* infection appeared to be limited to areas of exceptionally deep snow, while *C. graminicola* was more generally distributed.

It was noted that winter wheat injury in 1944–5 was almost entirely confined to the north-eastern counties, Fremont and Teton, where about half the acreage surveyed was winter-killed. In these badly infected areas, the ground is covered by snow before it becomes frozen and the soil remains unfrozen throughout the winter, a factor deemed highly important. It is commonly believed that early-sown wheat suffers most injury. A progressive annual increase of infection suggests a build-up of inoculum; some growers report no loss on new unbroken land. Adapted winter wheat is never killed outright by low temperatures: the primary cause of injury is attributable to the parasitic action of the *Typhula* and *C. graminicola*. It was noted that the Palouse area, the Camas Prairie area in Idaho county, and the south-eastern area of the State, according to available data, have suffered little from winter injury, although they have a snow cover similar to that in the affected areas. Losses have been reported from Nez Perce County in recent years.

Observations at the Tetonia Branch Station suggest that crop rotation is a factor in disease incidence. For example, half a field sown with sweet clover [*Melilotus* spp.] and then wheat showed hardly any winter mortality, but there was between 30 and 40 per cent. on the other half with mixed sweet clover and mountain brome [*Bromus marginatus*], followed by wheat. It appeared that crested wheat grass [*Agropyron cristatum*] in a rotation tended to increase winter mortality.

Blodgett (E. C.) & Schultz (H. K.). **Stem distortion of Wheat.**—*J. Amer. Soc. Agron.*, xxxviii, 8, pp. 717–722, 2 figs., 1946.

A peculiar type of stem distortion, transmissible through the seed, has been observed in several winter wheat varieties, including Triplet, Ridit, Hymar, and Turkey, in Idaho and the adjacent areas of Washington. Severely affected culms are dwarfed and remain exceptionally long in the boot stage. Close examination reveals a distorted condition, ranging from a sharp kink to an extremely twisted, looped, or knotted malformation, just below the head, which usually fails to emerge and becomes surrounded by a knot of stem tissue. One, two, or occasionally three culms on a plant may be involved. The disorder is probably attributable to a genetic factor or to a virus, though parasitic intervention is not excluded.

Shands (R. G.). **An apparent linkage of resistance to loose smut and stem rust in Barley.**—*J. Amer. Soc. Agron.*, xxxviii, 8, pp. 690–692, 1946.

The resistance of the Trebi barley variety to loose smut (*Ustilago nuda*) and a similar reaction of Chevron to stem [black] rust [*Puccinia graminis*] and other diseases [*R.A.M.*, xviii, p. 388] are of value in breeding programmes. Trebi is susceptible to *P. graminis* and Chevron to *U. nuda*. Floral inoculations with the latter were made on 98 F_5 plants of a bulk population from the cross of Chevron (C.I.) × Trebi (C.I. 936) selected for resistance to black rust. Over the five-year period from 1941 to 1945, the average incidence of *U. nuda* on Chevron, Trebi, and one of the resistant lines (H 47–26) was 48·6, 2·4, and 1·9 per cent., respectively. In a later test, five heads were inoculated with loose smut in each of 137 F_7 single-plant rows which were homozygous for resistance to black rust. In 136 of the lines there was an average of 67·9 per cent. loose smut, while the only one resistant to *U. nuda* appeared to possess a modified type of resistance to black rust, suggesting a linkage in that particular hybrid between the factors controlling reactions to the two diseases. Loose smut inoculations and exposure to epidemics of black rust over a period of several years showed that the selection H47–26 (Chevron × Trebi) did

indeed inherit a combination of resistance to both diseases. An unnamed variety, C.I. 4979, from Morocco, is resistant to mildew [*Erysiphe graminis*], leaf [brown] rust [*P. triticina*], and the two sporidium-forming smuts [*U. hordei* and *U. nigra*], and susceptible to black rust. In 1944 it also proved susceptible to *U. nuda*, which attacked all 59 plants in the test.

A random population of F_2 plants from H47–26 × C.I. 4979 was florally inoculated in 1944 with a composite collection of loose smut. Segregation for black rust reaction in the F_3 was 23 resistant, 53 heterozygous, and 24 susceptible, the average incidence of loose smut in the three categories being 1·3, 8·3, and 51·4 per cent., respectively. These results indicate a close linkage between the factors for black rust and loose smut reactions in H47–26, the Trebi resistance to *U. nuda* probably being controlled by a single dominant factor similar to that operating in the case of black rust in Chevron [loc. cit.].

PUGSLEY (A. T.) & VINES (ALISON). **Breeding Australian Barleys resistant to covered smut.**—*J. Aust. Inst. agric. Sci.*, xii, 1–2, pp. 44–47, 1946.

Experiments are described, using the inoculation method of Tapke and Bever [*R.A.M.*, xxii, p. 201], to determine the relative resistance of Australian barleys to covered smut (*Ustilago hordei*) and to identify the races of smut in Australia, and also breeding work designed to incorporate resistant genes in Australian varieties by back-crossing. Of 24 barley varieties tested by seed inoculation, Arlington Awnless, Chevron, Duplex, Gopal, Hillsa, Kwan, Lyallpur, Nepal, Nigrate, Peatland, and Peruvian were free from smut in both 1943 and 1944. The commercial Australian varieties were usually susceptible, Californian Feed Nos. 1 and 2 showing most resistance, and the first resisting well a further collection of covered smuts in 1945.

The three Australian smut collections used in these experiments appear to be similar to one another and to resemble most closely, though not completely, Tapke's race 5 [ibid., xvii, p. 308], when the varieties used by him are tested, but when Australian varieties are used differences are evident between the three.

From a study of the F_2 and F_3 generations from the cross Cape (susceptible) × Kwan (resistant), it appears that Kwan contains more than two dominant genes for resistance to covered smut. The material is being carried forward to the F_4 and F_5 generations to confirm this finding. Meanwhile, Kwan is being used as a source of resistant genes for transference to Prior, Research, Maltworthy, and Cape. Several F_5 lines of the cross (Kwan × Prior) × Prior are homozygous for resistance to collection I of *U. hordei*.

WALLIN (J. R.). **Seed and seedling infection of Barley, Bromegrass, and Wheat by Xanthomonas translucens var. cerealis.**—*Phytopathology*, xxxvi, 6, pp. 446–457, 1 fig., 1 diag., 2 graphs, 1946.

Seed and seedling infection of barley, brome grass, and wheat was investigated at the Iowa Agricultural Experiment Station in seeds artificially infected by races 1, 4, 5, and 6 of *Xanthomonas translucens* var. *cerealis* [*R.A.M.*, xxv, p. 389]. Hulled barley seed immersed for one hour in a suspension of the pathogen gave rise to 54 per cent. infected seedlings, compared with only 12 per cent. for non-hulled subjected to the same treatment, the latter requiring a 24-hour period of soaking to produce 50 per cent. diseased seedlings.

Seed germination and seedling disease in non-hulled Glabron and Velvet barley were not affected by the temperatures (between 10° and 35° C.) prevailing during seed infestation. The emergence of seeds attacked by race 6 of the parasite was lower than that of the controls at corresponding temperatures except at 35°, where the difference was negligible. The emergence percentage of seeds inoculated with this race was uniform at all temperatures except 30°, where it was appreciably lower (47 per cent. compared with 58 to 63). In the case of race 1, however, emergence

decreased regularly with rising temperatures, from 78 per cent. at 10° to about 12 per cent. at 30° to 35°. Similarly, the percentage of diseased seedlings arising from seed inoculated with race 6 averaged roughly 14 at all temperatures, whereas in the case of race 1 it ranged from a minimum of 6 at 10° to a maximum of 77 at 35°.

Infection of the test plants was facilitated by the rupture of the testa covering the embryo before seed inoculation. Non-hulled barley seeds inoculated with races 1 and 6 and planted in steamed soil produced a proportion of diseased plants, the former race being the more virulent; hulled seed was more vulnerable to both than non-hulled. In a further test with the four races of *X. translucens* var. *cerealis* on wheat and brome grass the latter was susceptible only to race 6, while all were capable of attacking the former. A few seedlings of each host arising from inoculated seeds planted in steamed soil contracted the disease.

Infection of the plumule took place through wounds or stomata on the coleoptile, spread rapidly through the invaded tissues, and eventually reached the enclosed foliage leaves, the first of which was involved before emergence from the coleoptile. With the elongation of the infected leaf the bacteria were carried into the aerial parts of the seedling and induced water-soaked streaks on the primary leaf.

HANSING (E. D.), HEYNE (E. G.), & STANTON (T. R.). **Reactions of Oat varieties and selections to four races of loose smut.**—*Phytopathology*, xxxvi, 6, pp. 433–445, 1 fig., 1946.

Greenhouse and field experiments were carried out to determine the reactions of a number of varieties and promising advanced hybrid selections of oats to four races of loose smut (*Ustilago avenae*) recently collected in Kansas [*R.A.M.*, xxiv, p. 446], designated A, B, C, and D, of which the first- and the last-named are distinct from any previously recorded, while B and C resemble Reed's A–1 and A–17, respectively [ibid., xix, p. 466].

In field tests with the 12 'smut-tester' varieties, race A was characterized by the susceptible reactions of Fulghum and Monarch and the resistance of Canadian. Richland and Victoria were susceptible to race D, while Fulghum was resistant.

Of the commercial varieties tested (besides those already mentioned), Boone, Cedar, Tama, Fultex, and Vicland were susceptible in the field to race D, Richland and Columbia were susceptible to races B and C, while Otoe was also susceptible to C. In nursery trials Florilee and Traveler were susceptible to race D. Ventura and Osage were susceptible to D in the greenhouse but intermediate to fairly resistant in the field, while some resistance to this new race was also shown in the field by Benton, Clinton, and Fulton, with 0, 0·1 to 0·5, and 4 per cent. smut, respectively (hulls on), and 3, 5, and 5, respectively, dehulled, and by Mission and Goldwin in the nursery (3 and 1, respectively).

Black Mesdag, Large Hull-less, Red Rustproof, Navarro, Markton, Brunker, Bond, New Nortex, Neosho, Bonda, Mindo, and several hybrid selections were highly resistant to all four races. Neosho is also resistant to the common races of crown and stem [black] rusts [*Puccinia coronata* and *P. graminis avenae*], besides possessing desirable agronomic characters. It therefore appears promising as a parent for oat crosses, and was distributed in Kansas in 1945.

MCKINNEY (H. H.). **Mosaics of winter Oats induced by soil-borne viruses.**—*Phytopathology*, xxxvi, 5, pp. 359–369, 4 figs., 1946.

Two viruses of winter oats have been observed over limited areas in North and South Carolina [cf. *R.A.M.*, xxiv, p. 274], Georgia, and Alabama, one of which is named apical mosaic (*Marmor terrestre* var. *typicum*) and the other eyespot mosaic (*M. terrestre* var. *oculatum*). The former induces on the Letoria and Victoria × Rainbow varieties at 60° to 65° F. pale green to yellow dashes and streaks running parallel with the long axis of the leaf, and sometimes chlorotic mottling, the patterns

being most conspicuous in or near the apical portions of the three upper leaves. At and above 75° the symptoms weaken and the new foliage is free from them. The same varieties react to the latter virus at 60° to 65° by the development of diffuse chlorotic patches and fusiform spots with pale green to ashen-grey borders and green centres, which are most pronounced in nearly or quite full-grown leaves.

Considerable difficulty was experienced in the transmission of the viruses, in contrast to those of brome mosaic (*M. graminis*) and wheat streak mosaic (*M. virgatum*), but with the aid of carborundum diseased juice extracts from mosaic oat plants were successfully inoculated into 972 out of 3,273 Letoria seedlings (29·7 per cent.) after an incubation period of 11 to 70 days. Oat mosaic appears to spread normally through the soil in which overseasoning takes place. Infection from the soil occurred within 35 to 60 days after sowing on plants grown out of doors during the autumn and early winter at Beltsville, Maryland. The mosaic symptoms found expression on the transference of the plants to a greenhouse with a temperature of 65°, but one of 60° appeared to be more conducive to the actual establishment of infection from the soil. *Avena byzantina* is also susceptible to *M. terrestre* and two out of 50 Michigan Amber wheat plants reacted positively to inoculation: maize is apparently immune.

The viruses were more destructive in 1944 than in 1945, though the incidence of infection was about the same in both years; the relatively slight damage in the latter may have been due to the abnormally high early spring temperatures. No evidence of seed transmission of oat mosaic was obtained. Control may be possible through the use of resistant lines and varieties.

Cercós (A. P.) & Favret (E. A.). **'Ustilago maydis', una nueva fuente de radiación mitogenética.** [*Ustilago maydis*, a new source of mitogenetic radiation.]—*Rev. argent. Agron.*, xiii, 2, pp. 128–137, 1 pl., 1 diag., 1946. [English summary.]

Maize smut (*Ustilago maydis*) was shown to be a source of powerful mitogenetic radiation. Strongly positive results were obtained by the exposure to its action, either directly or through quartz, for periods ranging from 10 to 96 hours, of moist photographic plates or films, the effect on dry ones, on the other hand, being barely perceptible.

Experiments with the electroscope showed that the tumours induced by the smut, as well as sporidial cultures, are capable of discharging the apparatus from a distance of 1 cm. and through quartz 0·7 mm. in thickness.

Pathology and mycology of Corn.—*Rep. Ia agric. Exp. Sta., 1944–45*, Part II, pp. 60–64, [? 1946].

I. E. Melhus and G. C. Kent [cf. *R.A.M.*, xxv, p. 339], using their method of inoculating maize plants with *Ustilago zeae* [*U. maydis*: ibid., xxiv, p. 365], found that percentages of smutted plants one week later among varieties from the Corn Belt were 97, among collections from the south-western United States, mostly from Indiana, 95·7, and among 77 Mexican and Guatemalan varieties 88·1, suggesting a higher resistance in these last varieties. Similar inoculations with other grasses showed that teosinte (*Euchlaena mexicana*) was susceptible, while gamagrass (*Tripsacum dactyloides*), Job's tears (*Coix lacryma-jobi*), grain sorghum, and Sudan grass were not infected. A culture of *U. maydis* from teosinte produced smut in maize and its own host.

A further investigation by I. E. Melhus and G. C. Kent of the growth of *Diplodia zeae* in soil, its survival in frozen soil, and manner of overwintering is being carried out. The optimum range of temperature for the growth of the organism in steamed field soil is 25° to 30° C.; minimum and maximum measurable growth in 7 days occur, respectively, at 5° and 40°. No reduction of viability was observed during 30 days' exposure at 10° C.

G. Semeniuk, C. S. Reddy, I. E. Melhus, W. E. Loomis, E. W. Lindstrum, and G. F. Sprague report treatments of U.S. hybrid 13 maize seed [loc. cit.] in co-operative tests with Minnesota, Iowa, Missouri, Wisconsin, Illinois, and Indiana, using spergon, arasan, barbak C, and new improved semesan jr. as dusts at 2, 1, $1\frac{1}{2}$, and $1\frac{1}{2}$ oz. per bush., respectively. Emergence improvement was recorded at six test places in plantings made in late April and through most of May. All the seed showed injury of the coat over the embryo and 30 per cent. carried seed-borne fungi. On the whole, arasan was better than, or as good as, spergon and semesan jr. under cold, wet soil conditions when germination took one or two weeks, while barbak proved slightly superior to spergon and arasan where emergence occurred in under a week. The treatments all gave greater seedling vigour. Marked differences in the materials were noted only in Iowa, where arasan seemed best and semesan jr. the least effective. Mesocotyl necrosis was reduced most by semesan jr. and less by arasan. Spergon and barbak C were generally ineffective except at the planting of 30th May. Semesan alone influenced (slightly) primary root necrosis.

When five-day-old seedlings of these 25 inbred lines, germinated from seed infected with *D. zeae*, were transplanted to the field, high susceptibility to that pathogen was shown by Oh 40B, M14, 38–11, 420, and Y63, while CC28, M8–29, Oh7, R4, 181–2, Y198, 1205, and WF9 were more resistant.

Wernham (C. C.). **Three hitherto unreported diseases of Corn in Pennsylvania.**—*Plant Dis. Reptr*, xxx, 1, pp. 26–28, 1946. [Mimeographed.]

In the course of research with hybrid maize at the Pennsylvania State College three diseases new to the State were reported, viz., *Helminthosporium carbonum* race II [*R.A.M.*, xxiii, p. 293], in Northampton County in September, 1944; *Cochliobolus heterostrophus* (*H. maydis*) [ibid., xxi, p. 71] at Lancaster in September, 1944; and crazy top in a small field of Ohio M 15 at Pennsylvania State College in 1944 with symptoms as described by Koehler [ibid., xix, p. 12]. Only certain lines, viz., I 11 Hy., Mo 940, and Minn C 11, were affected.

In 1945 *C. heterostrophus* caused the most serious leaf blight in south-eastern Pennsylvania and the southern areas of New Jersey. At Avondale, Chester County, Pennsylvania, it assumed epiphytotic proportions.

A notable feature of inoculation tests was the marked resistance to *C. heterostrophus* of inbred lines of Ind 461–3 and Ind Tr, which are highly susceptible to *H. turcicum* [ibid., vi, p. 157].

Pickett (B. S.), Godfrey (G. H.), Altstatt (G. E.), Melhus (I. E.), & Wallin (J. R.). **A disease of Corn in the Rio Grande Valley in Texas.**—*Iowa St. Coll. J. Sci.*, xx, 4, pp. 423–428, 2 figs., 1946.

Twice in 1945 maize plants growing in the Rio Grande Valley were found to be light yellow, streaked, and abnormally stooled, a condition attributed in the first case noted to unfavourable soil influences or lack of water, but found in the second case on experimental plots which were under irrigation. The plants also showed abnormal nodal bud extension, were bushy and often dwarfed, light green, while the leaves were sometimes red or bronze at the tips and edges or streaked with etiolated bands of varying widths; occasionally dwarfing was the only symptom observed. The most characteristic symptom throughout was the pronounced growth of shoots from the axillary buds, from all nodes below the ear shoot node. The lateral branches often grew to be 2 to 3 ft. long, terminated by male and female flowers, of which the latter usually produced some seeds.

The degree of shortening of the internodes depended on the period of development at which infection occurred. Internodes of plants affected early were shortened from the base to the tassel and those later only above the primary ear. Plants infected quite late showed no shortening. While early-infected

plants produced no marketable ears, those attacked later produced some marketable grain.

The disease, which was identified also on dent and popcorn, was most prevalent on the crop planted during January and February, the most important dent varieties, Tuxpan and Mesquitelena, being found infected. Several sweet maize varieties appeared susceptible. Infection in March-planted maize was less and almost negligible in that planted in April. The areas of highest incidence were Weslaco, where all maize types seemed badly damaged, and Santa Rosa, where popcorn suffered most. As no symptoms appeared in plants grown from seed produced by affected plants the disease is probably not seed-borne.

VIENNOT-BOURGIN (G.). **Les pourritures des Agrumes sur le marché français. Caractères biologiques et culturaux.** [Citrus rots on the French market. Biological and cultural characters.]—*Rev. Mycologie*, N.S., vii, 1, *Suppl.*, pp. 4–12, 1 pl., 1942. [Received July, 1946.]

Citrus rots that develop during transit cause serious losses in fruit carried loose in trucks, as is the case on the journey between Spain and France. The development of these diseases necessitates a preliminary inspection [on arrival] at which, sometimes, nearly 6 per cent. of the fruit may be found unfit for human consumption. A second examination when the fruit is sold for retail purposes, including packed as well as loose fruit, necessitates the rejection of a further 1 to 1·3 per cent. After this, the retail purchaser often finds that fruit apparently healthy when bought rapidly rots.

Of these rots the most important are *Penicillium italicum* and *P. digitatum*, the cultural and biological characters of which are fully described. Experiments showed that when dry spores of *P. digitatum* were placed in contact with fruit at 15° C. in a damp atmosphere infection became apparent in 48 hours, as against 60 hours for an aqueous suspension of spores on fruit in a dry atmosphere. Healthy fruits on which the peduncle scar is protected by lanoline or some similar substance resist attack by *P. digitatum* for long periods, but if a superficial scratch is made with a needle, affecting only the skin, infection can occur in four or five days, provided the oil glands have been destroyed; if the scratch involves the flesh, infection follows in 48 to 60 hours. Rots associated with *P. italicum* and *P. digitatum* are often aggravated by bacterial action.

Among other rotting agents on oranges the author found *Verticillium heterocladum* [cf. *R.A.M.*, x, p. 708; xi, p. 641]. The affected fruits developed a soft rot round the calyx, the skin rapidly turning leaden-grey. Inoculations of healthy fruits showed the organism to be parasitic. A *Periconia* sp. was found on flaccid oranges, showing apparently normal flesh but brown spots on the skin. Inoculations of healthy oranges with this fungus gave rise to similar symptoms.

Fungi isolated from deep or superficial skin injuries include *Septoria tibia* and *Macrosporium* sp. on lemons, and *Volutella fusarioides*, *Botrytis vulgaris*, and *Chondromyces* sp. on oranges. The parasitism of these organisms would appear to be secondary or nil.

[Some of the information presented in this paper also appears in *Fruits d'Outre-Mer*, i, 6, pp. 164–171, 6 figs., 1946.]

FREZZI (M. J.) & MÁCOLA (T.). **La podredumbre del pie de los Citrus en la Provincia de Córdoba, Argentina. Importancía, etiología y medios de lucha.** [Citrus foot rot in the Province of Córdoba, Argentina. Importance, etiology, and methods of control.]—*Rev. argent. Agron.*, xii, 3, pp. 203–211, 2 figs., 1 map, 1945.

The available information concerning citrus foot rot or gummosis (*Phytophthora parasitica*, *P. citrophthora*, and *P. palmivora*) and its control in the Province of Córdoba, Argentina, is recapitulated [*R.A.M.*, xx, p. 401; xxiii, p. 294].

Klotz (L. J.), Calavan (E. C.), & Zentmyer (G. A.). **The effect of Botrytis rot on Lemons.**—*Calif. Citrogr.*, xxxi, 7, pp. 247, 262, 5 figs., 1946.

The suggestion that the activity of *Botrytis cinerea* has reduced the set of young lemon fruits led to this inquiry by the authors. They found the fungus on bark and twigs damaged by frost, fumigation, oil spray, or shell bark [*Diaporthe citri*]. The importance of moisture for the establishment of infection by *B. cinerea* is emphasized.

Differences in the pathogenicity among strains or races of *B. cinerea* have been noticed. As a result of moist-chamber experiments it was found that blossoms remained unaffected until the time of petal-fall; infection of lemon fruits by contact with diseased petals could not be obtained; using an atomized suspension of the spores on small lemon trees in infection chambers in the orchard, the disease was produced on blooms in various stages of growth. Whether infection began only after the flower stalk started to absciss or whether it induced abscission is not certain, but in some cases the stalks showed penetration and decay before the completion of abscission. The fall of flowers and young fruit on inoculated trees was greater than on the uninoculated controls.

An increased fruit set of 35 per cent. occurred on trees sprayed with Bordeaux mixture. The following fungicides have been found to prevent the germination of *B. cinerea* spores: roccal, isothan, copper 8 hydroxyquinolinate, 604, spergon, zerlate, fermate, copper A, dithane with and without zinc sulphate and lime, zinc oxide, K1957, fungorex, cuprocide, and soda ash. Further spray trials are being conducted to test a variety of such materials.

McGillivray (K. D.). **New methods and an old menace. Bulldozers can help to control Armillaria.**—*Agric. Gaz. N.S.W.*, lvii, 7, pp. 362–363, 1946.

The successful use of bulldozers prior to citrus planting for clearing the land of stumps and roots of native trees, a source of infection by *Armillaria* [*mellea*], is reported from the Gosford–Wyong–Mangrove Mountain district of New South Wales.

Marchionatto (J. B.). **Nota relacionada con la etiología de la 'podredumbre de la raicilla' del Naranjo.** [Note relating to the etiology of the Orange 'rootlet rot'.] —*Rev. argent. Agron.*, xiii, 2, pp. 96–100, 1946.

The writer's hypothesis as to the causation of orange rootlet rot in Argentina by the nematode *Tylenchus semipenetrans*, with impoverishment of the soil and incompatibility between rootstock and scion as subsidiary factors, has already been noticed from another source [*R.A.M.*, xxiv, p. 227].

Silberschmidt (K. M.). **A 'mancha anular', uma nova doença de virus da Arruda (Ruta sp.).** ['Ring spot', a new virus disease of Rue (*Ruta* sp.).]—*Biológico*, xii, 8, pp. 219–220, 1 pl., 1946. [English summary.]

An account is given of a spontaneous ring spot of rue (*Ruta graveolens*) observed by N. R. Nobrega in São Paulo, Brazil. It is characterized by circular, milky-green spots on the new foliage and chlorotic rings with dark-green centres on the middle leaves, which acquire rugose surfaces. The disease was transmitted to healthy scions of *R. chalepensis* by grafting on dying *R. graveolens* stocks, and by the infective sap of the latter species to healthy plants of both. Plans are in hand for an intensive study of the possible connexion between the rue disease and the destructive 'tristeza' root rot of orange [*R.A.M.*, xxv, pp. 161, 302].

Smoyer (K. M.) & Halma (F. F.). **The rootstock factor in quick decline.**—*Calif. Citrogr.*, xxxi, 7, pp. 249, 282, 1 plate, 1 diag., 1946.

The results of a further survey of orange trees on sweet orange rootstock in the Upper and Lower San Gabriel valleys of California confirm the opinion that the

varieties on this stock are either highly resistant to or immune from quick decline [*R.A.M.*, xxv, p. 498, and above, p. 541]. No decline was observed on any trees on grapefruit, [*Poncirus*] *trifoliata*, or rough lemon stocks. No regular distribution or rate of spread of the disease was detected. In one orchard Eureka lemons on sour stocks showed no trace of decline, suggesting that this variety is immune.

Rohrbaugh (P. W.). **Mineral nutrient deficiencies in Cal. Citrus trees and their causes. I, II.**—*Calif. Citrogr.*, xxxi, 6, pp. 201, 225–228; 7, pp. 250, 258–260, 1 fig., 1 diag., 1946.

Surveys [*R.A.M.*, xxiv, p. 366] have shown that Californian soils have adequate supplies of the essential elements of nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, boron, zinc, and manganese required by citrus trees. The mineral-deficiency problem, apart from nitrogen, is largely one of unavailability, which is thought possibly to be due in part to high soil pH, with the result that these elements are held in insoluble forms. Remedial measures which may help are cultural practices which will improve drainage and aeration; use of acid fertilizers on light, well-drained soils not having a high boron or sulphur content; allowing alternate middles to dry out as the soil gains in acidity while drying, thus making some of the elements available to the trees; and applying trace elements in sprays.

In part II each element is reviewed in turn under the following headings: its function in the soil and in the plant, deficiency symptoms, excess symptoms, and recommendations for improvements.

Johnston (J. C.). **Trials with zinc-bearing dusts.**—*Calif. Citrogr.*, xxxi, 10, pp. 406–407, 1946.

Experiments with zinc-bearing dusts for the control of zinc deficiency or mottle leaf of citrus trees [*R.A.M.*, xvii, p. 743] were set up in November, 1934, by the Agricultural Extension Service in Tulare County, California; and in tests with zinc sulphate, zinc oxide, metallic zinc, and zinc sulphide the average percentage of mottle leaf observable in February, 1936, representing the average of four trials, was 41·7, 12·2, and 9·7 in respect of applications of 1, 2, and 4 per cent. zinc sulphate in talc, 1 lb. per tree, the untreated control registering 70 per cent. This result was markedly better than in the case of the other dusts used, although for practical purposes zinc oxide and metallic zinc at 4 per cent. gave adequate control. The addition to the dust of blood albumen as a sticker appeared to give no significant improvement.

Spraying of the whole ranch in February, 1935, with lime-sulphur and zinc sulphate resulted in the trees each receiving approximately 0·02 lb. zinc, which compares with the 2 per cent. dust plots. The zinc sulphate plot showed the best result with 8 per cent. mottle leaf and the zinc sulphide plot proved worst with 80 per cent. Excluding the zinc sulphide trial, the average of the 2 per cent. trials was 32·5 per cent., the dusts which equalled the spray in amount of zinc applied showing approximately twice as much mottled foliage as the sprayed trees. This confirms the results of previous trials and field experience.

Miller (E. V.). **Physiology of Citrus fruits in storage.**—*Bot. Rev.*, xii, 7, pp. 393–423, 1946.

In this critical review of the present state of knowledge concerning the physiology of stored citrus fruits [cf. *R.A.M.*, xviii, p. 673; xxiii, p. 104] the author deals with changes occurring during ripening, after picking, and in cold storage, and with respiration; he then discusses the physiological disorders that develop in cold storage, factors that affect the incidence of low-temperature injuries, the prevention of low-temperature breakdown, carbon dioxide storage, and ethylene treatment. The list of papers cited extends to 75 titles.

Muspratt (J.). **On Coelomomyces fungi causing high mortality of Anopheles gambiae larvae in Rhodesia.**—*Ann. trop. Med. Parasit.*, xl, 1, pp. 10–17, 1 pl., 1946.

Three species of *Coelomomyces*, designated types (*a*), (*b*), and (*c*), have been found as endoparasites of certain anopheline and culicine larvae, almost invariably in proximity to areas of loamy clay, at Livingstone, Northern Rhodesia [*R.A.M.*, xxv, p. 500]. Type (*a*), which appears to be closely related to *C. indiana* Iyengar (*Parasitology*, xxvii, p. 440, 1935), causes considerable destruction of *Anopheles gambiae*; (*b*) possibly akin to Walker's type 4 from Sierra Leone (*Ann. trop. Med. Parasit.*, xxxii, p. 231, 1938), parasitizes *A. gambiae* and *A. squamosus*; while (*c*), showing affinity with *C. stegomyiae* described by Keilin from Malaya [*R.A.M.*, vii, p. 322], has so far been found only on *Aëdes scatophagoides*. Once the fungal growths have reached maturity the larvae are incapable of pupation.

In the laboratory the thin-walled sporangia of types (*a*) and (*c*) germinated in water a few days after the death of the larvae, but the thick-walled ones, representing the resting stage, required two to three weeks' dry incubation at 28° C., followed by re-wetting, before germination took place.

Greaney (F. J.). **Cooperative Flax seed treatment tests in 1945.**—*Plant Dis. Reptr*, xxx, 4, pp. 113–119, 1946.

The results of this uniform flax seed-treatment experiment, presented in a fully tabulated account, show that losses in stands from fractured seeds are only partially remedied by seed treatment and the importance of preventing mechanical injury to flax seed intended for sowing is emphasized thereby [*R.A.M.*, xxiv, p. 507].

In yield experiments at the four Manitoba stations, new improved ceresan, arasan, and spergon produced no increases in yield of high-grade flax seed, but the first applied at 1, $1\frac{1}{2}$, or 2 oz. per bush. to badly fractured seed notably increased the yield. Arasan was less effective, but much more so than spergon. DuBay 1452–F, at $\frac{1}{2}$ and 1 oz., almost equalled new improved ceresan at these dosages. In the 1945 tests in Manitoba, higher yields were obtained from the heavier flax stands from non-fractured seed and from treated fractured seed, than from the lighter stands from untreated fractured seed.

Plant diseases. Notes contributed by the Biological Branch. Diseases of Roses.—*Agric. Gaz. N.S.W.*, lvii, 7, pp. 373–376, 6 figs., 1946.

The following principal diseases affecting roses in the coastal and tableland districts of New South Wales are briefly and simply described: black spot (*Diplocarpon rosae*); powdery mildew (*Sphaerotheca pannosa*); anthracnose (*Sphaceloma rosarum*); rust (*Phragmidium* sp.); stem canker (*Coniothyrium fuckelii* [*Leptosphaeria coniothyrium*]); and crown gall (*Agrobacterium* [*Bacterium*] *tumefaciens*). The measures for their control are specified.

Baker (K. F.) & Locke (W. F.). **Perithecia of powdery mildew on Zinnia seed.**—*Phytopathology*, xxxvi, 5, pp. 379–380, 1946.

In October, 1943, perithecia of *Erysiphe cichoracearum* developed in profusion in the inflorescences of *Zinnia* [*elegans*] in several commercial fields in Ventura and Santa Barbara Counties, California, especially on the Giant Dahlia Flowered Oriole variety. They were most abundant at the stylar end of the ovary and were usually formed at the lower edge of petal infections extending on to the achene. Of 20,861 seeds examined 3·42 per cent. harboured 1 to 9 perithecia and 0·7 per cent. 10 to 100. Of these seeds 9,253 were from a lot commercially threshed and cleaned by machine and they gave percentages of 1·97 and 0·34, respectively. Samples were grown in sterilized soil in the greenhouse for six weeks in the following spring, but no mildew developed on the plants, so that the ascospores, if released at all,

were evidently non-infectious. Repeated applications of sulphur dust in the early part of the growing season are recommended for the control of a disease that may materially reduce the yield and quality of the seed.

Bain (D. C.). **Die-back and stem canker of Camellia.**—*Plant Dis. Reptr*, xxx, 6, pp. 206–208, 1946. [Mimeographed.]

In nurseries along the gulf coast of Florida in February, 1946, die-back and canker were noted on both coloured and white varieties of *Camellia*. Tissue platings from plants showing both infections consistently yielded one or more species of *Gloeosporium*. Some of these isolates were shown experimentally to be able to produce die-back symptoms as observed in nature. It is considered that fungicidal spraying was adopted too late this year, as all the treated plants continued to show die-back and, if the author is correct in believing that infection takes place at or about the bud scale scars shortly after the buds begin to swell, spraying should begin before this and be continued until the shoots have passed the delicate stage of immaturity.

The varieties Magnoliae florae and Alba plena seemed most susceptible to the diseases, but no die-back or canker has been noted on Prof. Sargent and Perfection alba, although these were growing among others severely infected.

Thomas (H. Earl) & Hansen (H. N.). **Camellia flower blight.**—*Phytopathology*, xxxvi, 5, pp. 380–381, 1946.

Subsequent to the writers' determination of *Sclerotinia camelliae*, the agent of a floral blight of *Camellia [japonica]* in California, as a new species in 1940 [*R.A.M.*, xix, p. 350], they were informed by Professor I. Hino, Miyazaki College of Agriculture, that what appeared to be the same disease and fungus had been described by K. Hara in a Japanese journal some 20 years earlier. Notwithstanding the rather larger dimensions of the asci (120 to 140 by 6 to 8 μ) and ascospores (8 to 11 by 4 to 5 μ) of the Japanese species as compared with the American (100 to 125 by 4·3 to 5·8 and 5·3 to 7 by 2·5 to 3·5 μ), respectively, the fungus concerned in both countries appears to be essentially the same and should in future be designated *S. camelliae* Hara.

In April, 1943, blighted flowers and single petals bearing sclerotia were placed on soil in separate boxes, covered about 1 in. deep with peat moss, and placed under lath, the moss being kept continuously wet thereafter. On 24th February, 1944, apothecia were found in both boxes, and production continued until mid-April in the case of the whole flowers. Sclerotia of the latter left undisturbed in the box gave rise to apothecia from 6th February until 15th April, 1945, and fructifications reappeared in February, 1946.

Since only the ascospores are infective and open flowers alone are vulnerable, control should be practicable by the systematic destruction of diseased inflorescences, possibly supplemented by ground-spraying with fermate (4 lb. per 100 gals. water), which appears to inhibit apothecial formation.

Garren (K. H.). **A disease of English Ivy in Georgia.**—*Plant Dis. Reptr*, xxx, 6, pp. 209–210, 1946. [Mimeographed.]

Colletotrichum trichellum was isolated from diseased leaf and petiole tissue, but not from stems, of ground plantings of ivy (*Hedera helix*) from Atlanta, Georgia, the necrotic symptoms recalling those described by Weiss [*R.A.M.*, xxii, p. 481]. A species of *Phyllosticta*, however, was the fungus most frequently isolated from leaves and petioles. *P. hedericola* and *C. trichellum* were found as secondary invaders of greenhouse ivy by White and McCulloch [ibid., xiii, p. 773], and the lesions observed by the present author are similar to those reported by them. Stem isolations yielded *Fusarium* spp., *Diplodia* sp., and *Phoma* sp. with about equal frequency. Reinoculation tests are planned.

Trumble (H. C.) & Ferres (H. M.). **Responses of herbage legumes to applied nutrients on some southern Australian soils and their dependence on external factors.**—*J. Aust. Inst. agric. Sci.*, xii, 1–2, pp. 32–43, 1 fig., 7 graphs, 1946.

In the course of these studies [*R.A.M.*, xxiii, p. 244, and next abstract], zinc, molybdenum, and potash proved to be the most important, of nine mineral elements investigated, for the early growth of subterranean clover. In spite of the presence of copper in trace amounts in the distilled water employed, some responses to additional copper were obtained. The regions in which field responses to zinc and molybdenum may be anticipated are indicated. Light duration and temperature were shown to modify the response to zinc, the effects being on the plant and not on the soil.

Lucerne, [herbage] peas, barrel medick [*Medicago* sp.], subterranean clover, and strawberry clover [*Trifolium fragiferum*] all responded actively to molybdenum, the last three to zinc as well, but only lucerne gave a good response to copper.

Parbery (N. H.). **The effect of molybdenum on Clover growth on laterite soils.**—*Agric. Gaz. N.S.W.*, lvii, 7, pp. 343–347, 4 figs., 1946.

While the use of molybdenum oxide at 4 oz. per acre on moderately deteriorated laterite soil in New South Wales increased somewhat the growth of subterranean clover [*R.A.M.*, xxv, p. 36, and preceding abstract], it had no effect in the presence of lime or dolomite; and while it promoted marked increase of growth on two similar soils, a combination of phosphate and dolomite was much more effective. Whatever improvement molybdenum may make to base-impoverished soils, it is nevertheless important to remedy major basic deficiencies in these soils.

Wahlin (B.). **Sjukdomar och skadedjur på Rödklöver i Östergötland 1945.** [Diseases and pests on Red Clover in east Gothland 1945.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1945*, 6, pp. 88–92, 1 map, 1945.

Red clover in east Gothland, Sweden, where the crop is intensively cultivated for seed, suffered considerable damage in 1945 from rot (*Sclerotinia trifoliorum*) [*R.A.M.*, xxv, p. 103], which reduced the stand by over 25 per cent. in places. *Botrytis anthophila* [ibid., xviii, p. 742] was observed in several localities, its incidence generally averaging from 1 to 2·8 per cent. (maximum 5).

Decker (P.). **The effect of depth of planting on the emergence and survival of Blue Lupine.**—*Phytopathology*, xxxvi, 6, pp. 479–480, 1 fig., 1946.

In an experiment to determine the effect of planting depth on the loss of blue lupin seedlings from *Rhizoctonia* spp. in Florida, where the crop is grown as a winter cover, 200 seeds were planted in the greenhouse in each of 16 flats containing field soil from the surface 3 in. In eight of the flats the planting depth was 1 in. and in the remainder 2 in. Five days later 94·1 per cent. of the seedlings in the 1-in. flats had emerged, whereas the maximum of 54·7 per cent. for the 2-in. planting was not recorded until the tenth day. In the shallow plantings the seedlings were killed by the fungus over small, localized areas, whereas there were only a few scattered survivors in the deeper ones. Three weeks after planting, 70·7 per cent. of the shallow-planted seedlings, which had attained an average height of 8 in., appeared healthy, while only 6·5 per cent. of those in the 2-in. flats were alive.

Weimer (J. L.) & Elrod (J. M.). **Powdery mildew of annual Lespedezas.**—*Plant Dis. Reptr*, xxx, 1, pp. 13–16, 1946. [Mimeographed.]

Although powdery mildew (*Microsphaera diffusa*) is not a serious pathogen of the bush clover (*Lespedeza*) plant, the rather wide distribution of the disease in 1945 on test plots of *L. striata* and *L. stipulacea* at the Agricultural Experiment Station,

Georgia, led the authors to investigate the severity of *M. diffusa* in nursery rows and on plants naturally inoculated in the greenhouse.

Field observations on 19 strains of Kobe *L. striata* and 21 of Korean *L. stipulacea* showed considerable variation in the incidence of the disease, which ranged on the former from 1 to 6 on a rating scale of 1 to 10 (0 representing freedom from, and 10 extreme infection), and on *L. stipulacea* from 0 to 9. Seven selections of Korean were rated at 0 but none of Kobe were free from mildew. The senior author's greenhouse observations in 1943 disclosed similar wide variation in the resistance to and amount of disease under different conditions. Individual plants in some of the 17 strains being grown were quite free from disease, although growing in pots among many badly infected plants. One strain of Korean remained consistently free from mildew.

The general results of these tests are considered to show that while there is a tendency for strains of *L. striata* to be more susceptible than those of *L. stipulacea*, as suggested by Johnson *et al.* [*R.A.M.*, xix, p. 657], there are many exceptions.

SPRAGUE (R.). **Fungi isolated from dormant grasses at Mandan, North Dakota, in January.**—*Plant Dis. Reptr*, xxx, 4, pp. 111–112, 1946. [Mimeographed.]

In the course of isolations of fungi from roots obtained from frozen and snow-covered perennial grasses during sub-zero weather an abundant recovery of *Fusarium* [*scirpi* var.] *acuminatum* [*R.A.M.*, xxiv, p. 222] was made, notably from a creeping strain of *Agropyron michnoi* and from lucerne included for purposes of comparison with the grasses. There was no evidence at Mandan of severe injury to these grasses caused by a species of Basidiomycete such as that reported from Alberta [ibid., xxi, p. 143], at least under the conditions of the closed winter of 1945–6.

JENKINS (ANNA E.), FORSELL (M. J.), & BOYLE (L. W.). **Identity and known distribution of Elsinoe piri in Washington and Oregon.**—*Phytopathology*, xxxvi, 6, pp. 458–461, 1 fig., 1 map, 1946.

Elsinoe piri has been isolated from apple and pear leaves [*R.A.M.*, xix, p. 366; cf. also viii, p. 469] in several localities of Washington and Oregon, this being the first record of the occurrence of the fungus in North America, where the economic importance of the susceptible crops invests the discovery with special interest. On Grimes Golden apple fruits the spots were generally brick-red (Ridgway) paling towards the centre with advancing maturity. On a seedling apple the lesions were particularly vivid, the smaller ones being pomegranate-purple, the larger and more diffuse areas Eugenia-red, and the centres of the older spots purple-brown, contrasting with the lumier- and light lumier-green of the healthy apple skin. A single collection of Washington quince leaves also yielded *E. piri*.

The fungus occurred exclusively in its imperfect state, *Sphaceloma pirinum* (Pegl.) Jenkins n.comb. [*Gloeosporium pirinum* Pegl.]. Conidia were seldom detected on the linear, sometimes branched, dark pustules protruding through epidermal fissures. The spots on pear leaves resemble those on apple foliage, and further agree with Arnaud's description of a pear leaf spot in France, now referred to *E. piri*.

The accompanying map indicates the wide distribution of the pathogen west of the Cascade Mountains.

TUNBLAD (B.). **Några iakttagelser i samband med besprutningsförsök mot skorv.** [Some observations in connexion with anti-scab spraying experiments.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1945*, 6, pp. 87–88, 1945.

Comparative spraying experiments against apple scab [*Venturia inaequalis*] were carried out in the Mälordal district of Sweden in 1945 on the Sävstaholm and

Signe Tillisch varieties as follows: (1) control; (2) Bordeaux mixture throughout, 0·8–2·4–100 before and 0·5–1·5–100 after blooming; (3) Bordeaux before and lime-sulphur (3 per cent.) after; (4) lime-sulphur throughout (4·5 per cent. before and 3 per cent. after). The sprays were applied to both varieties on 3rd May, 12th and 27th June, and 27th July, with a final treatment on Signe Tillisch on 28th August.

The infection percentages on Signe Tillisch in the different categories were (1) 57·6, (2) 9·7, (3) 31·4, and (4) 27·3, and for Sävstaholm 70·3, 24·1, 26·9, and 10·7, respectively, and the average weights (in gm.) of sound fruits in the former variety (1) and (2) 144, (3) 130, (4) 133, and in the latter (1) 64, (2) 106, (3) 93, and (4) 86, respectively.

BJÖRLING (K.). **Fortsatta rön angående en nyligen beskreven Äpplesjukdom.** [Further observations on a newly described Apple disease.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1945*, 6, pp. 92–94, 2 figs., 1945.

In the summer of 1945 *Pleospora mali* [? *P. herbarum*] and *Stemphylium congestum* (both regarded as forming part of a disease-complex) were again isolated from 19 out of 31 unripe Bramley's Seedling apples in three localities in south Scania, Sweden [*R.A.M.*, xxiv, p. 454]. The fruits of a single tree in one of the orchards visited bore dark-coloured (mostly black) lesions, while a few showed the pale yellow, waxy spots associated with incipient water core. The dead fruit spurs on the tree yielded *P.* (?) *herbarum* in pure culture. The majority of the affected apples were situated on the south side of the tree, and sun scald is therefore presumed to be the primary cause of the trouble, with the fungi as secondary invaders of the wounded tissues.

BJÖRLING (K.) & NILSSON (L.). **Bakteriell hagelskottsjuka pa Plommon.** [Bacterial shot hole disease on Plum.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1945*, 6, pp. 81–84, 4 figs., 1945.

In the middle of July, 1945, specimens of plum leaves and fruits with bacterial shot hole were received at the Åkarp branch of the Swedish Plant Protection Institute. The leaves were studded with holes of varying dimensions and brown to blackish-brown, dry, hard spots, some of which had largely parted from the surrounding healthy tissue and were on the point of dropping out; their edges consisted of a narrow zone of dry, brown or blackish-brown tissue. Some leaves were so severely attacked that practically nothing was left but the midrib and a narrow, ragged strip of the adjoining lamina. The fruits bore numerous necrotic depressions, up to several mm. in diameter, the larger ones partly or wholly filled with a solid gummy exudate. Many of the heavily infected leaves were adhering firmly to the fruits. Besides the Åkarp outbreak the disease was later observed in two nursery-gardens at Alnarp, where the foliage only was affected. Of the three commonly grown varieties, Victoria, Jefferson, and Ontario, the first-named was the only one to suffer extensive damage, involving 50 to 60 per cent. of the fruits.

Of 25 isolates from leaf and fruit spots transferred to meat peptone agar, five were pathogenic to inoculated unripe fruits; one of them was grey-white and originated in the foliage, while the others were yellow and emanated from both leaves and fruit.

In cultural studies two of the four yellow isolates produced on meat extract agar yellow, circular, even colonies agreeing with those of *Phytomonas* [*Xanthomonas*] *pruni*, while the grey to blue growth made by the grey-white strain was characteristic of *Pseudomonas prunicola* [*R.A.M.*, xxv, p. 349]. All the cultures were still viable after 12 days and only the grey-white one had succumbed at the end of 23, in contrast to *Phytomonas* [*Pseudomonas*] *mors-prunorum*, which was shown by Wormald to secrete acid so rapidly and profusely as to die within a week [ibid., xii,

p. 227], whereas *P. prunicola* is much slower in this respect. The grey-white isolate and two of the yellow strains further agreed with *P. prunicola* and differed from *P. mors-prunorum* in the production of acid from lactose. The thermal death points of *P. prunicola* and *X. pruni* are 46° and 51° C., respectively, that of *P. mors-prunorum* being unknown. The grey-white isolate was killed by exposure to 47°, while the yellow ones survived. All the Swedish plum strains were Gram-negative, like *X. pruni* and *P. prunicola* and in contrast to the Gram-positive *P. mors-prunorum*. The grey-white bacteria consist of rods measuring 1·3 to 3·1 by 0·6 to 0·9 μ, sometimes united in chains up to 6 to 7 μ long, corresponding to *P. prunicola*.

It is concluded that the agent of the shot hole disease of plums in Sweden is obviously distinct from *P. mors-prunorum*. The grey-white foliar organism bears a strong resemblance to *P. prunicola*, while a couple of the yellow ones are somewhat akin to *X. pruni*. Further studies are planned to determine the exact relationship between the Swedish and foreign bacterial pathogens of the plum.

MILLTHORPE (F. L.) & VINCENT (A. E.). **Bacterial canker of stone fruit.**—*Agric. Gaz., N.S.W.*, lvii, 5, pp. 255–257, 9 figs., 1946.

Bacterial canker of stone fruits, due to *Pseudomonas cerasi* var. *prunicola* [*P. prunicola*: xvi, p. 328; see also preceding abstract; and *P. mors-prunorum*: ibid., xviii, p. 746] occurs throughout New South Wales, causing serious losses among all stone fruits. A description is given of the leaf and shoot symptoms and of the two types of cankers 'gummosis canker' and 'sour sap canker', a brown, moist condition of the bark, first appearing as a slightly sunken area, and later emitting a sour, fermented odour.

Tentative control measures recommended are as follows. Pruning should be completed as soon as possible after leaf-fall. The trees should be sprayed in early May, mid-June, and late July with Bordeaux mixture (15–15–100) plus ½ gal. white oil per 100 gals. or a good spreader. Varietal resistance has been observed and is being investigated.

DE ONG (E. R.). **Injury to Apricot leaves from fluorine deposit.**—*Phytopathology*, xxxvi, 6, pp. 469–471, 1 fig., 1946.

Lucerne and other pasture crops, Tilton apricot, English walnut, and White Adriatic fig trees, lilac, blackberries, roses, *Hydrangea* [*hortensis*], and a single plum tree suffered more or less severe injury in California in 1943 and 1944 from the fluorine [cf. *R.A.M.*, xxii, p. 119] in the fumes emanating from a neighbouring aluminium plant.

The intensity of the symptoms varied with the distance from the plant and culminated in the extensive defoliation of trees in its immediate proximity. For instance, in a 40-acre Tilton apricot orchard, some 60 per cent. of the trees had shed their leaves by 1st August, 1944, while the bulk of the remaining foliage was brown and necrotic, as though scorched by fire. The young twigs exuded copious amounts of gum, pockets of which were also situated at the crown in some five-year-old trees. The 1945 crop yielded only about half the normal quantity of fruit, presumably on account of premature defoliation and bud injury in 1944. The amounts of fluorine determined on leaves taken at random from fig and apricot orchards ranged from 247 to 403 parts per million.

The first foliar symptom on apricots was observed two to three weeks after the trees came into leaf and consisted of a progressively increasing marginal wilt, involving a width of ⅛ to ⅜ in. and causing necrosis of the affected tissues in about ten days. The damage, which was confined to nearly full-grown leaves, persisted without interruption for about two years, when the plant was closed down. The same type of symptoms, declining *pari passu* with distance from the source of the trouble, occurred for eight miles to the windward.

Gigante (R.). **Il giallume del Pesco.** [Peach yellows.]—*Boll. Staz. Pat. veg. Roma*, N.S., xxii, 3–4, pp. 173–180, 3 figs., 1942. [Received June, 1946.]

Peach trees growing at Grottarosea, near Rome, showed symptoms agreeing perfectly with those of peach yellows as reported from the United States [*R.A.M.*, xxiii, p. 28; xxiv, p. 128]. Grafting experiments successfully transmitted the disease and so confirmed the identity of the condition with yellows.

Stout (G. L.) & McClain (R. L.). **Peach wart found in California.**—*Plant Dis. Reptr*, xxx, 6, pp. 202–203, 1946. [Mimeographed.]

A manifestation of peach wart [virus] disease, showing symptoms characteristic of those described by Blodgett [*R.A.M.*, xxii, p. 213] was found for the first time in California in June, 1945, on the Candoka variety at one ranch in San Bernardino County with a large acreage of peach trees of many varieties. The infection is thought to have arisen from scion wood and from 15 Candoka nursery trees imported from Washington in 1941, the former having been used for the top-working of some 285 peach trees. Inspection of other Candoka plantings disclosed only a few trees similarly attacked, all on properties within a few miles of each other. All warted trees have been removed and close watch is being kept for additional suspects.

Mills (W. D.). **Temperature effects on the expression of the yellows virus in sour Cherries.**—*Phytopathology*, xxxvi, 5, pp. 353–358, 1946.

The expression of the cherry yellows virus [*R.A.M.*, xxiv, p. 236] in New York orchards in any given season depends primarily on the prevailing temperature during the month following the petal-fall stage. High temperatures at this time decrease the symptoms of the disease, which appeared in a mild form in the 17 years between 1921 and 1945 when the mean temperatures 1 to 10, 11 to 20, and 21 to 30 days after petal-fall were 62·9°, 65·6°, and 68·6° F., respectively, and in a severe one in the eight years when the corresponding temperatures were 55·4°, 58·9°, and 63·9°, respectively. On the other hand, abnormally high March and April temperatures tend to increase the subsequent development of yellows by expediting bloom and so exposing the trees at a critical period to the generally low temperatures following petal-fall and favouring the external manifestations of the virus. The severity of the symptoms did not appear to be affected by the amount of precipitation.

Since the temperatures prevailing after petal-fall cause a great variation in the apparent amount of yellows present in an orchard from year to year, the spread of virus after the trees are set can neither be proved nor disproved by any of the observations made to date on the external symptoms of the disease in two different seasons.

Johnson (F.). **Physiologic races of yellow rust of Raspberries in western Washington.**—*Phytopathology*, xxxvi, 5, pp. 383–384, 1946.

Experimental evidence is adduced in favour of the hypothesis that two distinct physiologic races of raspberry yellow rust (*Phragmidium rubi-idaei*) [*R.A.M.*, xiii, p. 526] exist in western Washington. Both the Cuthbert and Washington varieties were shown by cross-inoculation tests to be susceptible to the form present on the latter in Whatcom County, while Washington proved to be resistant to that collected from Marlboro and Cuthbert in the Puyallup Valley. For many years the disease has been a limiting factor in the cultivation of red raspberries in the west of the State, but it was only in 1944 that moderate to severe infection was observed on the supposedly immune or highly resistant Washington variety in commercial fields in Whatcom County. Neither in 1944 nor in 1945 did rust occur on the

Lloyd George and Newburgh varieties in proximity to Washington. In the Puyallup Valley Cuthbert and Marlboro were attacked, while Washington bore only an occasional sorus. So far no infection has been found on Tacoma.

Sakimura (K.). **Two species of thrips non-vectors of the spotted wilt virus.**—*J. econ. Ent.*, xxxix, 3, pp. 398–399, 1946.

Experimental evidence is tabulated and analysed to show that two species of thrips, namely, *Frankliniella sulphurea*, a recent immigrant into Hawaii, and *Anaphothrips* (*Chaetanaphothrips*) *orchidii*, well established in the Islands, are incapable, in contradistinction to *Thrips tabaci*, of transmitting the pineapple spotted wilt virus [tomato spotted wilt virus: *R.A.M.*, xix, p. 483] from diseased to healthy plants. The writer previously obtained similarly negative results with *T. nigropilosus* and *Hercinothrips femoralis* (*J. econ. Ent.*, xxxii, p. 383, 1939).

Bock (E.). **Une technique nouvelle de préparation de bouillies de traitements antiparasitaires.** [A new technique for the preparation of mixtures for antiparasitic treatments.]—*Progr. agric. vitic.*, cxxv, 18–19, pp. 303–308, 3 figs., 1946.

A description is given of a new apparatus for preparing fungicidal and insecticidal sprays on a large or small scale which was introduced into Alsace during the war. Twenty of these installations have been set up in the vine-growing areas of the department, and all have given complete satisfaction. An essential condition is a supply of water at a minimum pressure of two atmospheres.

Receptacles of 400 and 600 l. capacity are used for preparing 10 per cent. solutions of lime and copper sulphate, respectively. These receptacles are connected with a 'Mix' apparatus [*R.A.M.*, xix, p. 229] so arranged that the mixtures can be made in any ratio or dilution desired. The method effects great economies in time, labour, and expense.

Schnicker (J. L.). **Kemikaliekontrollen i 1945.** [Inspection of chemical substances in 1945.]—*Tidsskr. Planteavl*, l, 3, pp. 526–538, 1946.

Notes are given on the various infringements of the Danish plant-protective and poison laws detected in the course of the official inspection in 1945 of 347 samples. Analyses are furnished of a number of fungicides and insecticides recognized by the Danish Plant Protection Service.

Kearns (H. G. H.). **Hydraulic spraying machinery for fruit crops. The choice of power equipment.**—*Rep. agric. hort. Res. Sta. Bristol, 1945*, pp. 110–132, [? 1946].

In this paper are set out the biological requirements for spraying fruit crops, and information on technique, choice of machine, the types of power equipment, which are classified, and specifications of machines and component parts.

Ciferri (R.). **Manuale di patologia vegetale.** [A manual of plant pathology.]—xxiii+730 pp., 256 figs., Genova, Società Anonima Editrice Dante Alighieri (Albrighi Segati, e C.), 1941. 188 L. [Received August, 1946.]

In this work, intended primarily for University students, the author has aimed at avoiding generalities and describing definite, typical diseases of recognized theoretical and practical importance, particularly in Italy. The first section (124 pp.) deals among other matters with the history of the subject, the concept of disease, the relation between ecological factors and plant infection, predisposition,

susceptibility, resistance, and immunity, the physio-pathology of parasitism, the natural enemies of parasites, disease prevention and control, and symptomatology. The second part (pp. 125–231) deals with non-parasitic diseases, the third (pp. 232–310) with virus diseases, the fourth (pp. 311–356), with diseases due to bacteria and Actinomycetes, the fifth (pp. 357–363) with those caused by Myxomycetes, the sixth (pp. 364–652) with fungous diseases, and the seventh (pp. 653–687) with parasitic phanerogams. There is an alphabetical index to the names of Italian authors mentioned, and the subject index fills 37 pages of small print. The whole work is fully illustrated with figures and photographs.

PETRI (L.). **Alcune questioni di fitopatologia generale. Introduzione al 1° corso di specializzazione in discipline fitopatologiche tenuto alla Facoltà di Agraria della R. Università di Pisa.** [Some questions of general phytopathology. Introduction to the first specialized course in phytopathological studies held in the Faculty of Agriculture of the Royal University of Pisa.]—*Ann. Fac. agr. Pisa*, N.S., iii, 18, pp. 229–261, 7 figs., 1940. [French, German, and English summaries. Received August, 1946.]

This paper consists of the first two lectures of a course for University students on problems in general phytopathology. In the first lecture the author deals generally with plant immunity from and resistance to infective diseases.

In the second lecture the author discusses the predisposition of plants to disease (distinguishing between normal or physiological, and abnormal or pathological predisposition), pathological processes accompanying infection, variation in fungi (physiologic races), and the question of degeneration due to senility.

MOORE (W. C.). **New and interesting plant diseases.**—*Trans. Brit. mycol. Soc.*, xxviii, 3–4, pp. 127–133, 2 pl., 1945.

This is a further contribution to the series [cf. *R.A.M.*, xxii, p. 364] recording new plant diseases in Britain. A scale-spotting of Yellow Prince tulip bulbs was encountered in 1934 and again in 1941 from Lincolnshire, where the disease occurs every year in a number of varieties and is sometimes the source of heavy loss. The outer scale of each bulb, though turning brown, was still somewhat fleshy and immature and on removal brown markings were visible on the first fleshy scale below. Many were pale, brown, indefinite, isolated spots a few mm. in diameter, coalescing where numerous to form irregular patterns on the surface of the scale. Some bulbs showed large, slightly sunken, rounded or heart-shaped areas with definite margins on the 'cheek' of the bulbs, some of which stood out in marked contrast to the white portions of the scales. Later these areas developed light and dark brown rings and streaks, the brown markings penetrating into the scale, but rarely, if ever, extending through to the inner surface; however, similar though fewer markings were occasionally evident on the outer surface of the next inner scale. The disease was recognized by E. van Slogteren as one common in Holland, and he regarded it as physiological in origin; it was usually most virulent on the best stocks and heaviest bulbs. It is reported to be particularly prevalent when bulbs are lifted in wet conditions and stored too close in warm, badly ventilated sheds. Inoculations with isolated bacteria and with diseased tissues gave negative results, and the cause of this scale-spotting still remains undetermined.

The specific identity of a *Fusarium* sp. isolated in September, 1941, from green walnuts, which exhibited small, black, sunken areas at the stigmatic end of the green husk, and its causal relation to the disease still remain uncertain. Other walnut fruits showed as a primary symptom a relatively inconspicuous and roughly circular patch about 1 in. in diameter on one side of the husk immediately below the old stigmatic remains. The tissues of this patch were uniformly raised or irregularly raised and paler than the remainder of the husk, frequently yellowish,

and surrounded by a black band, which broadened to form a more or less complete, depressed, transversely cracked ring. Ultimately the green husk showed a blackish sunken patch 1 in. or more across on one side of the fruit, the blackening tissues becoming studded with the orange sporodochia of a species of *Fusarium*. The affected fruits were mostly immature and the inner shell relatively soft. Sooner or later the testa blackened and the flesh was reduced to a soft, yellow-brown mass. The *Fusarium* spores on the surface of the blackened fruits were usually 3- to 4-septate, the former measuring 22 to 33 by 3 to 4 μ and the latter 30 to 39 by 4 to 5 μ. Pure cultures were obtained from the sporodochia and the same fungus was isolated, though not consistently, from the shell.

Spinach leaves attacked by *Heterosporium variabile* were received from Wimborne, Dorset, in May, 1944. They showed small, scattered, sharply defined, rounded, white spots, 1 to 3 mm. across, mostly on the upper half of the leaf, surrounded by a very narrow shrivelled or water-soaked band. On others representing a later stage the spots had mostly coalesced, were crowded towards the tip of the leaf, and had dark olive-green or black spore tufts. In the final stages the leaves were almost covered with small, separate, dark fungus mats 1 to 3 mm. in diameter, at first mainly ephiphyllous and then more or less equally abundant on both sides of the leaf.

A strain of *Botrytis cinerea* was isolated from dead sainfoin [ibid., xxv, p. 166] seeds, the contents of which were mostly reduced to an amorphous mass, and the external parts to a skeletal network of the more resistant tissues, in which a number of black, sausage-shaped, curved or irregular sclerotia, about 3 mm. long, were embedded.

Leaves, red berries, and the calyx of the box thorn (*Lycium halmifolium*) in a Bodmin (Cornwall) garden at the end of the wet August of 1942 were thought to have been attacked by *Phytophthora infestans* [cf. ibid., vi, p. 48], which was extremely prevalent in the district at that time. The leaves were brown and withered at the tips and many showed large, round, brown spots on the lamina, sometimes reaching the margin. Exposure of the leaves for 24 hours in a damp dish produced a copious halo of *P. infestans* growing out from the still green tissue surrounding the brown lesions. The fungus was found on damp fallen leaves and was present also on some of the fruits. Slices of healthy potato tubers inoculated with spores from the *Lycium* leaves and berries developed a luxuriant growth of *P. infestans* in a day or two. Inoculation experiments on healthy *Lycium* leaves with spores from blighted potato leaves produced lesions similar to those on the shrub. This appears to be the first record of an occurrence of *P. infestans* on a *Lycium* sp. in the British Isles.

Celery seedlings 1 in. or more high from Cambridgeshire, presenting symptoms of the type of root rot caused by *Phoma apiicola* [ibid., xv, p. 275], showed on examination by A. Smith no pycnidia of that fungus, but yielded pure cultures of a fungus identical with *Alternaria radicina* [ibid., xv, p. 768], not previously reported on celery in Great Britain.

Examination by A. Smith of leaves of young wheat plants, grown in Hertfordshire, which became yellow and withered following a fall of snow, disclosed a few small, brown or greyish-brown sclerotia recalling the disease caused by *Typhula graminum* [ibid., xvi, p. 802]. In March the wheat in the field was growing vigorously and it was only after careful search that two or three plants could be found bearing sclerotia on the oldest withered leaf sheaths. Apart from some dwarfing the parts seemed healthy. No sporulation occurred in pure cultures isolated from the sclerotia, but little doubt is entertained that the fungus is *T. graminum* [ibid., xv, p. 347; xix, p. 434]. On dextrose agar the fungus produced one or more coralloid masses of sclerotia, honey-coloured or pinkish at first, but soon becoming reddish-brown with a rather glistening appearance.

Wilson (E. E.) & Baker (G. A.). **Some features of the spread of plant diseases by air-borne and insect-borne inoculum.**—*Phytopathology*, xxxvi, 6, pp. 418–432, 5 graphs, 1946.

Numerical data relating to the spread of plant diseases from infection foci to the aerial organs of neighbouring susceptible hosts were compiled from the relevant literature, and the rate at which the incidence of attack diminished with increasing distance from the source of inoculum examined. The diseases fell into three categories in respect of the mode of inoculum dissemination, i.e., caused by (1) fungi spread by means of air-borne spores [*R.A.M.*, xxv, p. 352], (2) bacteria transported by wind-blown rain, and (3) viruses and fungi transmitted through the agency of insect vectors.

The infection gradients developing in proximity to sources of inoculum were compared with the pattern shown by previous investigations to characterize the aerial dissemination of spores. For example, in the authors' observations in California on this aspect of apricot brown rot (*Sclerotinia laxa*), submitted for publication to *J. agric. Res.*, for a minimum distance of 15 ft. from the source, the density, or number of air-borne conidia traversing areas of planes perpendicular to the direction of the wind, diminished in inverse proportion to the square of the distance from the focus of infection, and the rate at which dispersion (the scattering of spores in dimensions perpendicular to the direction of the wind) increased was directly proportional to the distance from the source. Thus, the gradient of aerial spore density was described by the equation $Y = \frac{100}{x^2}$, where Y is the density at x_2 and subsequent distance intervals expressed as a percentage of the density at x_1, or first distance interval. In the case of diseases resulting from air-borne spore infection, the decrease in incidence with increasing distance from the source was described with a fair degree of accuracy by a modified form of this equation, viz., $Y = \frac{100(1+a)^2}{(x+a)^2}$. The investigations of Posey and Ford [*R.A.M.*, iv, p. 199] and Buchanan and Kimmey [ibid., xvii, p. 495] on the spread of white pine blister rust (*Cronartium ribicola*) from currants to pines afford suitable illustrations of the application of this equation.

Faulwetter's data concerning the spread of angular leaf spot of cotton (*Phytomonas* [*Xanthomonas*] *malvacearum*) by wind-blown rain (*J. agric. Res.*, viii, pp. 457–475; x, pp. 639–648, 1917), those of Linn on the transmission of [aster] yellows of endive by leafhoppers [*Macrosteles divisus*: *R.A.M.*, xx, p. 337], of Frampton *et al.* on the dissemination of the potato yellow dwarf virus by the clover leafhopper [*Aceratagallia sanguinolenta*: ibid., xxii, p. 75], and of Zentmyer *et al.* on the transmission of Dutch elm disease [*Ceratostomella ulmi*] by bark beetles (*Scolytus multistriatus*) [ibid., xxiv, p. 211], also present certain analogies with the diseases carried by air-borne spores in respect of the relationship between the amount of infection and distance from the focus.

The equation used by Gregory [ibid., xxiv, p. 378] for the transfer of atmospheric properties by eddy diffusion, and representing the dispersion of air-borne particles downwind from a point source, was examined. When normal values for the constants of this equation were employed, the resulting curve did not differ significantly from that given by the equation referred to above when $a = 0{\cdot}21$, but at low atmospheric turbulence or during brief periods of observation of spore dissemination, the curve of Gregory's equation represents a slower decrease in the incidence of infection with increasing distance than does the curve of the authors' equation. The major difficulty in the application of the eddy diffusion equation to disease-gradient data lies in its failure to account for the combined effects of a large number of variables, and the family of curves produced by the authors'

equation seems more appropriate to the disease conditions encountered in the field.

Brown (A. E.). **The problem of fungal growth.**—*Mod. Plast.*, xxiii, 8, pp. 189–195, 254, 256, 7 figs., 1946.

The protection from fungal decay of plastic materials under tropical conditions presents many difficulties. In this paper the author examines and discusses the experimental evidence on these problems submitted from Service organizations, industrial laboratories, and university projects to a special subcommittee, established in 1944, of the Tropical Deterioration Administrative Committee of the National Defense Research Committee [cf. *R.A.M.*, xxv, p. 466].

The use of starch-sized in place of de-sized duck in laminates enhanced the susceptibility of the plastic, and paper-based laminates were easier to protect than cloth-based. The sizing on the glass cloth was often responsible for the fungal invasion of phenolic-glass laminates.

Preventol [ibid., xxv, p. 131], copper naphthenate, hydrocide 10X special, and milban, incorporated into vinyl chloride-acetate polymer at the rate of 2 per cent., conferred a degree of protection on material plasticized with tricresyl phosphate and methyl acetyl ricinoleate. Judged by soil-burial tests, milban appeared to be the most effective. After 100 days' hanging in a tropical room the treated plastics were less overgrown by fungi than the control sample.

The incorporation of mercurial fungicides, e.g., phenyl mercuric salicylate, at 0·25 to 2 per cent., in thermoplastic has also been tested on a considerable scale. Plasticizers compatible with these compounds are dibutyl tartrate, dimethyl phthalate, santicizer M–17, triacetin, and triphenyl and tricresyl phosphates. This treatment enabled a number of materials to pass the Signal Corps Specification 71–2202A, involving the use of *Aspergillus niger* as a test organism. Protection was conferred by this means on cellulose acetate plasticized with santicizer M–17, ethyl cellulose plasticized with the foregoing or tricresyl phosphate, and cellulose nitrate plasticized with tricresyl phosphate. A phenyl mercurial compound (0·5 to 1 per cent.) likewise induced a fungistatic reaction in polystyrene and contact laminating resins of the styrene copolymer type, while less than 1 per cent. phenyl mercuric salicylate sufficed to inhibit mould growth on vinyl copolymers. Phenolic resins were much more refractory to chemical protection. Resistance was imparted to phenol-formaldehyde, cellulose-filled plastic by the addition of 2 (and in some cases 1) per cent. of a phenyl mercuric fungicide.

Fleming (Sir A.). **Chemotherapy. Yesterday, to-day, and to-morrow.**—39 pp., 2 pl., 5 figs., Cambridge University Press, 1946. 2*s*.

In this Linacre lecture for 1946 the history of chemotherapeutical research is traced briefly and illuminatingly from the work of Pasteur up to the present time, when Fleming's own discovery of penicillin has stimulated a great volume of investigation on antibiotics generally. He makes a powerful plea for the speedy endowment of microbiological research.

Gilliver (K.). **The inhibitory action of antibiotics on plant pathogenic bacteria and fungi.**—*Ann. Bot., Lond.*, N.S., x, 39, pp. 271–282, 1946.

The bactericidal and fungicidal powers of 13 antibiotic substances against 33 important plant pathogens were studied in serial dilution tests, which showed that bacteria on the whole were inhibited by more substances and at higher dilutions than fungi. On certain Gram-positive bacteria the highest titres were recorded for gliotoxin [*R.A.M.*, xxi, p. 216; xxv, p. 75], penicillin [ibid., xx, p. 484; xxiv, p. 140], and tyrothricin [gramicidini: ibid., xxi, p. 248]. Gram-positive and Gram-negative bacteria were inhibited at approximately equal dilutions by penicillic acid [ibid.,

xxi, p. 344], aspergillic acid (*J. Bact.*, xlv, p. 461, 1943), and claviformin [*R.A.M.*, xxiii, pp. 183, 267]. The highest sensitivity in fungi was exhibited by *Phytophthora erythroseptica* and *Pythium ultimum*. Resistance was much higher in sporing than in non-sporing fungi. Aspergillic acid and cheiroline (from *Cheiranthus* spp., unpublished work) inhibited almost all the fungi tested; claviformin inhibited fewer fungi, but at rather higher dilutions. The possibility of using claviformin, gliotoxin, penicillin, gramicidin, cheiroline, and aspergillic acid for controlling certain bacterial and fungal plant diseases was suggested by the results of these experiments.

Rao (R. R.) & Venkataraman (P. R.). **Relations between the source of nitrogen and antibiotic formation by Aspergillus fumigatus, Fresenius.**—*Nature, Lond.*, clviii, 4007, pp. 241–242, 1946.

The authors' cultural experiments show that the Czapek-Dox medium favours the formation of the antibiotic products (fumigatin, spinulosin, helvolic acid, and gliotoxin) of *Aspergillus fumigatus* [*R.A.M.*, xxiii, p. 268; xxv, p. 175], the pH shifting from the acid to the alkaline side; with other inorganic and simple organic sources of nitrogen there was no antibiotic activity, and the reaction became more acid. When the fungus was grown on groundnut cake hydrolysate, activity decreased after the third day, but the addition of 0·5 per cent. sodium chloride or 2 per cent. sodium acetate appeared to exert a stabilizing influence. Wheat bran cultures indicated that *A. fumigatus* seems to utilize preferentially complex sources of nitrogen for the production of antibiotic.

Bose (S. R.). **Antibiotics in a Polyporus (Polystictus sanguineus).**—*Nature, Lond.*, clviii, 4009, pp. 292–296, 1 fig., 1946.

In further experiments polyporin [*R.A.M.*, xxiv, p. 463] was obtained from cultures of *Polystictus sanguineus* grown in various Czapek-Dox media with manganese sulphate added and in some cases with extracts of pea seed, green grass, and autoclaved wheat. *Staphylococcus aureus*, *Streptococcus pyogenes*, *S. viridans*, *B*[*acillus*] *typhosus* and *B. paratyphosus* A and B, *B. flexner*, *B.* [*Bacterium*] *coli*, and *V*[*ibrio*] *cholerae* proved susceptible to polyporin. Positive results in the clinical treatment of various local infections are recorded. An account is given of chemical investigations and methods of extraction of the antibiotic.

Dey (N. C.). **On the production of streptomycin. I.**—*Sci. & Cult.*, xii, 2, pp. 100–103, 1946.

Particulars are given of the composition of 11 media, including Waksman's glucose broth [*R.A.M.*, xxiv, p. 426], which proved satisfactory for streptomycin production from *Actinomyces griseus* in the author's tests by the stationary surface culture method (pH 6·8) at the Bose Research Institute, Calcutta.

Feustel (I. C.) & Humfeld (H.). **A new laboratory fermenter for yeast production investigations.**—*J. Bact.*, lii, 8, pp. 229–235, 1 fig., 1946.

An improved laboratory fermenter is described for the culture of yeasts, *Saccharomyces cerevisiae* and *Torulopsis utilis* [*R.A.M.*, xxv, p. 464], employing mechanical agitation for the dispersal of air. Cell concentrations of *T. utilis* of approximately four billion, corresponding to a yeast volume of 3·6 ml. per 15 ml. culture liquid, were obtained in the new fermenter without diminution of the average propagation rate of upwards of 40 per cent. per hour.

Beeson (K. C.). **The effect of mineral supply on the mineral concentration and nutritional quality of plants.**—*Bot. Rev.*, xii, 7, pp. 424–455, 1 diag., 1946.

The author reviews and discusses, with 124 references to published literature, the present state of knowledge concerning the effects of fertilizers, including micro-

nutrients, on the concentration of certain elements in and the nutritional quality of plants.

SNYDER (W. C.), THOMAS (H. EARL), & FAIRCHILD (S. J.). **A type of internal necrosis of the Potato tuber caused by psyllids.**—*Phytopathology*, xxxvi, 6, pp. 480–481, 1 fig., 1946.

In connexion with a recent study of spindling sprout in White Rose potatoes [*R.A.M.*, xxiii, p. 454] in California, several dozen tubers from plants artificially infested by psyllids were examined for internal symptoms. They had been stored for six months or so at room temperature and had produced either spindling sprouts or none. All revealed characteristic dark flecks, containing amorphous to smooth, spherical bodies of variable size, in the vicinity of the smaller vascular elements, extending throughout the length of the tuber but rather more prominent at the stem end. At a later stage, the discrete, dark, intracellular elements associated with the spotting had disappeared. In other psyllid-induced cases of spindling sprout internal necrosis was not observed [cf. ibid., xxiv, p. 70].

FOLSOM (D.) & STEVENSON (F. J.). **Resistance of Potato seedling varieties to the natural spread of leaf roll.**—*Amer. Potato J.*, xxiii, 7, pp. 247–264, 1946.

In breeding against potato leaf roll, one of the most important diseases of the crop in Maine, European and American varieties, mostly reputed to be resistant, were used as possible sources of resistance, and resistant seedlings from these were used for further crossings. In 1941 and 1944, when leaf roll was severe, many seedlings from B24 (Imperia × Earlaine), two from X247 (Kepplestone Kidney × Earlaine), and one from X1276 (Houma × Katahdin), showed high resistance to the disease.

In 1943 hybrids between resistant seedlings gave better results than those between resistant seedlings and commercial varieties, 40 per cent. of the former developing leaf roll as against 61 per cent. of the latter. In 1944 seedlings introduced from crosses with one Highmoor Farm resistant seedling parent produced 14 times as many seedlings not contracting leaf roll as did those from crosses in which some other European or seedling variety, presumed to supply factors for leaf-roll resistance, was employed.

It is suggested that the wide distribution of leaf roll in 1941 and 1944 may have been promoted by the dispersal of aphid vectors of the disease from infected to healthy plants earlier than usual in the host's development, with the result that the less mature hosts became more acutely infected, but at the same time the authors hold that aphid resistance in seedlings is not necessary for field resistance to leaf roll.

These experiments have shown the possibility of finding potato seedlings resistant to leaf roll in nature and of building-up virus resistance still further by using some of these resistant seedlings as parents [*R.A.M.*, xxii, p. 369]. It is also thought possible to combine field resistance to leaf roll with many characteristics regarded as commercially desirable in America.

ROSS (A. F.). **Susceptibility of Green Mountain and Irish Cobbler commercial strains to stem-end browning.**—*Amer. Potato J.*, xxiii, 6, pp. 219–234, 1 fig., 1946.

Güssow (*Amer. Potato J.*, xix, pp. 280–282, 1942) recommended the elimination from seed stocks of all tubers showing symptoms of stem-end browning, thus implying its propagation in the tuber. The present author describes a series of experiments with Green Mountain and Irish Cobbler potatoes, to which varieties the disease is usually restricted in the State of Maine, and it is shown that stem-end browning is clearly related to the source of the seed tubers, and that the differences of susceptibility among lots are reproduced in the tuber and are not caused primarily by environmental conditions.

Little sign of the disorder is found at digging time; consequently the tubers were stored at 50° F. for 90 or more days before being examined for the disease [*R.A.M.*, xxiii, p. 272]. Preliminary experiments showed that, apart from one lot (later found to be mixed), the crop produced from diseased seed developed no more stem-end browning than that grown from healthy tubers. There seemed nothing to be gained by discarding seed tubers showing stem-end browning.

Data collected over five years showed that all lots of Irish Cobbler were equal in susceptibility and were similar to the Keswick strain of Green Mountain, both producing considerably more stem-end browning than other Green Mountain stocks from Maine and other States.

As a result of selection over a three-year period among potatoes from different areas it was shown that resistant lines tended to retain their resistance and susceptible lines their susceptibility. A comparison of these selected lines with the original lots revealed only two levels of susceptibility to stem-browning. Most commercial lots belong to one class or the other but some are mixtures, and only for these would the discarding of seed tubers seem of practical use. A better practice would be to eliminate mixed lots and secure a strain known to be resistant. In general, the susceptible type or strain showed two to seven times as much stem-end browning as the more resistant strains, according to environmental and cultural conditions during growth. Tuber lines selected from either type were no more or less susceptible than the original unselected lot.

Late blight of Potatoes.—*J. Dep. Agric. Vict.*, xliv, 8, pp. 269–271, 2 figs., 1946.

Although usually unimportant in Victoria, potato blight [*Phytophthora infestans*: *R.A.M.*, xvi, p. 118] can in favourable conditions cause upwards of 75 per cent. loss of the crop. Among methods found satisfactory for controlling the disease, special importance attaches to seed selection, as infected seed is the main source of outbreaks. As these are, however, infrequent, spraying is recommended as economic only in areas particularly subject to blight.

Andrén (F.). **Ob-medlen mod Potatisbladmögel.** [The Ob treatment of Potato blight.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1945*, 6, pp. 95–96, 1945.

In experiments carried out in 1945 in Sweden 1 per cent. Ob 2300, the best of the Bordeaux substitutes tested, did not equal Bordeaux mixture in the control of potato blight (*Phytophthora infestans*) [see next abstract]. An increase in the concentration to 2 per cent. is recommended.

Åtgärder för bekämpande av bladmögel och brunröta hos Potatis. [Control measures against leaf mould and brown rot of Potatoes.]—*Flygbl. Växtskyddsanst., Stockh.*, 80, 8 pp., 4 figs., 1946.

In this pamphlet, a revised edition of No. 70 in the same series, 1945, originally issued in 1933 [*R.A.M.*, xiii, p. 123], instructions are brought up to date for the control of potato blight [*Phytophthora infestans*] in Sweden. Copper oxide preparations, e.g., Ob 2300 [ibid., xxii, p. 444, and preceding abstract], cuzol, or kopsit are reasonably effective except under conditions tending to epidemic outbreaks of the disease, such as prevailed in 1945, when they cannot compete with Bordeaux. For the destruction of the haulm 1 per cent. sodium chlorate (also toxic to *P. infestans*) is recommended.

Holmberg (C.). **Drivbänksförsök med tidiga kräftimmuna Potatissorter.** [Forcing bench experiments with early wart-immune Potato varieties.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1946*, 3, pp. 40–42, 1946.

Experiments were carried out at the Swedish Plant Protection Institute from 1942 to 1946, inclusive, to determine the relative cropping capacities, under

forcing-house conditions, of some early potato varieties immune from wart disease [*Synchytrium endobioticum*: *R.A.M.*, xxv, p. 521].

Conflicting results were obtained with Dunbar Yeoman, the yield of which in three years (1942, 1944, and 1945) from home-grown, virus-infected 'seed' fell considerably below that of the susceptible Early Puritan used for comparative purposes (83·7 : 100), whereas the tubers of outside provenance grown in 1943, 1945, and 1946 outyielded the standard variety by 29 per cent. Irish Cobbler was slightly less productive than Early Puritan (98·8 : 100), its vigorous aerial system precluding full development on the greenhouse bench. Di Vernon and Dukker outyielded Early Puritan by averages of 5 and 3 per cent., respectively. W.40731, a selection from Weibullsholm Plant Breeding Institute, not yet on the market, proved a heavy cropper, excelling Early Puritan in this respect by a three-year average of nearly 24 per cent., but its very displeasing tuber shape is a great drawback. Sv. 42096 (Swedish Seed Association) was fully as productive as Early Puritan in 1946, and its well-shaped tubers are a further advantage. The average numbers of tubers per plant were as follows: Di Vernon and Sv. 42096 11, Dunbar Yeoman 9·5, Dukker 9, Early Puritan, Irish Cobbler, and W.40731, 8.

JØRSTAD (I.). **Melding om Potetkreften (Synchytrium endobioticum) i Norge for årene 1939–1945.** [Report on Potato wart (*Synchytrium endobioticum*) in Norway for the years 1939 to 1945.]—*Meld. St. Plantevern, Oslo*, 2, 34 pp., 1 map, 1946.

This is a tabulated survey of the 387 new foci of potato wart (*Synchytrium endobioticum*) detected in Norway since the publication of the writer's last report on the disease [*R.A.M.*, xix, p. 427], in which the relevant information available up to and including 1938 was presented. During the eight-year period under review, the maximum number of fresh centres of infection (129) was recorded in 1944, and the minimum (11) in 1941. Since 1935 a number of zones have been partially or wholly released from quarantine, including 69 properties under surveillance for periods of 12 to 30 years.

A few observations were made in 1941 on the persistence of the fungus in a viable condition in the soil [ibid., xxv, p. 79]. In a light soil allowed to revert to grass for the entire 16-year period since the disease was observed there was no trace of infection on the new crop of a susceptible variety. In a deep, heavy mould, in which immune varieties had been grown, with the exception of a few years, since 1925, one tuber was found infected, while in another fairly heavy soil in the same locality, under grass until two years before the trial, there were five diseased tubers.

LUTZ (L.). **Sur la dégénérescence gommeuse des tubercules de Pomme de terre.** [On the gummy degeneration of Potato tubers.]—*C.R. Acad. Agric. Fr.*, xxvi, 19, pp. 664–668, 1940. [Received July, 1946.]

During the winter of 1939–40 Esterlingen potatoes stored in a clean cellar showed wrinkling of the skin. When cut, they displayed a brown, shiny appearance. The medullary region showed large cavities, round which the tissue was dry and pale brown. The internal surface of the cavities was covered with a white mycelial mat. Slightly affected tubers showed only brown marbling towards the centre, with a tendency for the section to blacken rapidly. Some tubers, when sectioned, emitted copious insoluble brown gum from the shiny zone. Microscopic examination showed that this region was the seat of a typical gummy degeneration of the cell walls, though the starch grains appeared to be unaffected. From the protoplasm of the affected cells two organisms were isolated, a bacterium with morphological and biological characters resembling those of *Bacillus solaniperda* [? *Erwinia phytophthora*: *R.A.M.*, x, p. 125] particularly in its ability to liquefy gelatine rapidly, and a fungus identified provisionally as *Fusarium caeruleum*.

Inoculations of healthy tubers with each organism separately gave negative results, but when both were used together the original symptoms were again produced. Stored potatoes should be examined at intervals and affected tubers destroyed, the apparently healthy ones then being treated with formalin solution.

WALLACE (T.) & CATLOW (E.). **Manurial experiments on vegetable crops. IX. Effects of farmyard manure and of various fertiliser treatments on three varieties of Potato.**—*Rep. agric. hort. Res. Sta. Bristol, 1945*, pp. 95–102, [? 1946].

In experiments with Majestic, Kerr's Pink, and Red King potatoes, grown on plots used for continuous vegetable cropping, the effects of dung and various fertilizer treatments showed in the growth and foliage characters. It was possible to distinguish, both visually and by chemical tests, the effects due to deficiency of nitrogen, phosphorus, potassium, and magnesium and high contents of chloride. Dung induced low nitrogen status and nitrogen-phosphorus-potassium and phosphorus-potassium treatments resulted in magnesium deficiency. Nitrogen and potassium deficiencies reduced tuber production most seriously and phosphorus deficiency, while delaying growth early in the season, later did not prevent good, healthy haulm development and high tuber yields. Foliage injury caused by chloride treatments did not affect yields which approximated to those from nitrogen-phosphorus-potassium applications where sulphate was substituted for chloride. Comparison of the seven crops grown since 1940 showed that while low nitrogen and phosphorus status materially reduced yields of *Brassica* crops, low potash status was unimportant, though of great importance for carrot, onion, beet, and potato. Cooking quality of tubers was little affected by manurial treatment, although omission of potash resulted in slight blackening, which was also produced by salt (sodium chloride) dressings in the variety Majestic.

NICHOLAS (D. J. D.). **The application of rapid chemical tests in the diagnosis of mineral deficiencies in Potato plants.**—*Rep. agric. hort. Res. Sta. Bristol, 1945*, pp. 60–80, 4 graphs, [?1946].

During 1945 potatoes growing at four centres under various manurial treatments were tested by the tissue-test technique [*R.A.M.*, xxv, p. 9] enabling comparisons to be made of the same crop plant growing on different soil types and under varied fertilizing conditions. The results, fully tabulated, are accordingly set out.

GANGULY (D.). **A note on the occurrence of Cercospora oryzae Miyake on Paddy in Bengal.**—*Sci. & Cult.*, xi, 10, pp. 573–574, 1 fig., 1946.

In July, 1945, Dharial rice plants at the Bengal Agricultural Institute, Tejgaon, Dacca, were found to be suffering from a severe leaf spot, the symptoms of which were in close agreement with those described by Tullis for the disease caused by *Cercospora oryzae* [*R.A.M.*, xvii, p. 201]. In the current season the same variety was also affected at the Perhampore Farm, Bengal, and Naizarasail was attacked at Dacca. The morphological features of the pathogen, of which this is believed to be the first record from India, correspond with Miyake's description, except for the conidial catenulations, not hitherto associated with the species. This characteristic would place *C. oryzae* in Solheim's genus *Ragnhildiana*, rejected by Muller and Chupp on the grounds of its evanescence [ibid., xv, p. 59].

HEWITT (E. J.). **Experiments in mineral nutrition. III. The visual symptoms of mineral deficiencies of crop plants grown in sand culture. Progress Report, 1945.**—*Rep. agric. hort. Res. Sta. Bristol, 1945*, pp. 44–51, [? 1946].

A further survey is made of characteristic visual symptoms of mineral deficiencies in 29 cereal, vegetable, and other crops [*R.A.M.*, xxv, p. 9] grown in controlled, large-scale sand cultures during 1945.

Hewitt (E. J.). **The resolution of the factors in soil acidity. Progress report I. Season 1945.**—*Rep. agric. hort. Res. Sta. Bristol, 1945*, pp. 51–60, 2 figs., [? 1946].

In this study of factors governing soil acidity observations are recorded and descriptions given of deficiency and toxicity symptoms noted during preliminary sand-culture experiments with cauliflower and runner bean (*Phaseolus vulgaris*) [*R.A.M.*, xxv, p. 197].

Negroni (P.) & Negri (T.). **Flora de 'Aspergillus' del suelo de Buenos Aires.** [*Aspergillus* soil flora of Buenos Aires.]—*Physis, B. Aires*, xv, 47, pp. 193–212, 11 figs., 1939. [Received September, 1946.]

Ten out of 25 compound samples of Buenos Aires soils yielded species of *Aspergillus* in pure cultures on soil extract and Czapek's agar, comprising five strains of the *A. niger* group, four of *A. terreus*, two each of *A. sulphureus* and *A. flavus-oryzae*, and one of *A. nidulans*.

Krassilnikov (N. A.). Влияние растительного покрова на микробный состав почвы. [Microflora of soils as influenced by plants.]—микробиология [*Microbiology*], xiii, 5, pp. 187–198, 4 graphs, 1944. [English summary.]

This paper summarizes the results of some years' observations by the author [*R.A.M.*, xv, p. 520] and by Korenyako [*Microbiology*, xi, 3, p. 105, 1942] on the micropopulations of the rhizospheres of crop plants in different field and greenhouse soils and when grown experimentally in nutrient solutions [*R.A.M.*, xxii, p. 78]. In general the number of species in a rhizosphere is limited to two or three (rarely four to six). Non-sporulating bacteria make up 95·5 per cent. of the species found in rhizospheres.

According to their relationships with *Azotobacter* the author classifies plants into three groups, (*a*) encouraging and increasing it, (*b*) depressing or suspending it, (*c*) without effect. Mycolytic bacteria (particularly those attacking *Verticillium dahliae*) [ibid., xxii, p. 267] develop well under lucerne and clover but not at all under cotton and flax. The species attacking *Fusarium* sp. was more abundant under fallow strips than under crops.

The findings emphasize the need for varied and suitable rotations based on a study of rhizosphere populations.

Mathur (R. S.). **Control of Sugar-cane smut in the United Provinces.**—*Indian Sug.*, viii, 12, pp. 439–440, 1945.

The following are the principal measures to be adopted in a campaign against sugar-cane smut [*Ustilago scitaminea*] in the United Provinces, India. The acreage under such highly susceptible varieties as Co. 313 and Co. 312 should be considerably reduced; the moderately susceptible Co. 370, Co. 385, Co. 513, Co. 290, and Co. 214 should be closely watched; and the cultivation of the fairly resistant Co. 356, Co. 419, Co. 421, Co. 395, and P.O.J. 2878 should be encouraged.

The disease is readily transmitted through the setts, and before the commencement of planting their state of health should be verified. A few of the best fields should be reserved immediately after germination to supply seed for the next year's crop. For every ten acres of planting, one acre should be set aside for seed plots, to be maintained under optimum conditions for the raising of a vigorous crop. Regular inspections should be made for diseased plants and any found collected and destroyed. Infection may take place at any stage in the growth of the cane from germination in April until the crop is ready for harvest, and intensive searches for the young smut 'whips' still encased in the membranous sheaths should be made at

1-5 —4

frequent intervals from April to June. Gangs of trained boys are provided with cloth bags, with which the whole of the infected clump is enveloped before being eradicated. When the bags are full, they should be boiled at the factory for half an hour, and the contents then taken out and burnt.

The first flux of smut appears on ratoons and on planted crop raised from diseased setts. Every care must be taken to remove the smut 'whips' which would act as sources of secondary infection if left out in the plots. Other channels of secondary infection are the neighbouring fields of commercial crops, and roguing operations should therefore be continued during the period from October to December.

Setts from the nursery plots should be planted in the multiplication plots belonging to registered growers, who should be convinced, in the first place, that systematic anti-disease campaigns are economical, and secondly that any negligence on their part in the rapid destruction of infected material will be as harmful to themselves as to their neighbours. Factory-owners should, if necessary, provide the requisite equipment free or subsidize its purchase.

Marchionatto (J. B.). **Notas micológicas.** [Mycological notes.]—*Physis, B. Aires*, xv, 47, pp. 133–144, 9 pl., 1939. [Received September, 1946.]

Aecidium berberis-ruscifoliae Henn., collected on *Berberis ruscifolia* leaves in Argentina by L. R. Parodi in 1933, is suspected of constituting a phase in the life-history of wheat black rust (*Puccinia graminis*), but inoculations on wheat failed.

Asperisporium caricae was found on papaw [*R.A.M.*, xxi, pp. 184, 324] leaves in the Province of Salta. Spegazzini (*Fungi guaranitici*, No. 385) reported the occurrence on *A. caricae* of a hyperparasite, *Rhinotrichum gossypinum* Speg., which was also isolated by the author from the papaw leaf spots; its characters in pure culture were those of an *Acremonium*.

Cephalothecium [*Trichothecium*] *roseum*, first identified on rotting cotton bolls in 1925, has since been observed fairly frequently on the same host.

Cercospora epicoccoides Cke and Mass. was detected for the first time in 1928 on the foliage of *Eucalyptus globulus* and *E. rostrata*, and has been prevalent since that date in coastal nurseries, producing reddish-purple, later pallid, misshapen spots, 2 to 3 mm. in diameter, on the leaves. *C. cichorii* was found in 1933 forming roughly circular, chestnut-brown lesions, becoming concentrically zonate, on chicory leaves [ibid., xxii, p. 177]. *Salix matsudana* in a nursery planting was attacked in 1935 by *C. salicina*, producing round, wine-coloured spots, 1 to 1·5 mm. in diameter, over-running the leaf veins.

Cytospora chrysosperma [ibid., xix, p. 623] was found attacking the branches of Lombardy poplar [*Populus nigra* var. *italica*] and indigenous willows [*Salix*] in the Province of Buenos Aires and on islands in the Paraná Delta. L. R. Parodi collected in 1934 on poplar (*P.* sp.) leaves a fungus, *Taphrina aurea* [ibid., xxiii, p. 254], hitherto recorded only once for Argentina by Spegazzini (*Fungi argent.*, No. 716) in 1898.

Colletotrichum phomoides was observed on tomato fruits in 1928.

Cladosporium paeoniae is the agent of pale chestnut-coloured lesions on peony leaves [ibid., xxii, pp. 67, 170], sometimes involving a large part of the surface. *Erysiphe polygoni* was collected in 1935 on *Delphinium ajacis* [ibid., xix, p. 475], this being the first record of the mildew on the host in question in Argentina. *Gloeosporium cyclaminis*, the causal organism of a very destructive disease of *Cyclamen* in Italy [ibid., v, p. 741], was first observed on specimens of the same host from Bella Vista, Argentina, in 1932, inducing a snuff-coloured tinge and tissue shrinkage in the peduncles.

Raspberries and *Rubus ulmifolius* were found to be infected by *Plectodiscella veneta* in its imperfect state (*Gloeosporium venetum*) in 1932, this being the first record of the fungus for Argentina. The perithecial phase was detected by L.

Grodsinsky in 1934. *Mycosphaerella rubi* was observed in its imperfect state (*Septoria rubi*) on raspberry in 1932.

Phleospora multimaculans Heald and Wolf was first detected on black walnut leaves from Córdoba in 1929, the initially minute, chestnut-coloured spots enlarging to cover the entire surface.

Guignardia bidwellii, in its imperfect state (*Phoma uvicola*) only, was determined for the first time in 1933 as the agent of vine black rot. Virginia creeper (*Parthenocissus tricuspidata*) was recognized for the first time in Argentina as a host of *Plasmopara viticola* [ibid., xxiv, p. 5] in 1935.

Sclerotinia opuntiarum Speg. has been observed on wild and cultivated *Opuntia* spp. since 1921, but all attempts to induce the germination of the young sclerotia on the plants have given negative results. *Sclerotium bataticola* [*Macrophomina phaseoli*] was found destroying the medulla of the basal internodes of a maize stem at the Pergamino Experiment Station in 1934. *Spondylocladium atrovirens*, the agent of silver scurf of potato tubers, was determined for the first time in Argentina in 1934. *Zizyphus vulgaris* leaves were infected in 1935 by *Uredo zizyphi*.

Rhoads (A. S.). **A contribution to the fungus flora of Utah and Nevada.**—*Plant Dis. Reptr*, Suppl. 162, pp. 67–99, 1946. [Mimeographed.]

The lists of fungi in this supplement comprise miscellaneous collections made in Utah and Nevada during the latter part of 1944 and the first half of 1945. They include two Phycomycetes, 31 Ascomycetes, 60 Uredinales, four Ustilaginales, 19 Basidiomycetes, and 13 Fungi Imperfecti.

Lindquist (J. C.). **Especies argentinas del género 'Peronospora'.** [Argentine species of the genus *Peronospora*.]—*Physis, B. Aires*, xv, 47, pp. 13–20, 1939. [Received September, 1946.]

This is a critically annotated list of 15 species of *Peronospora* collected, some for the first time, in Argentina, including the widespread and destructive *P. aestivalis* on lucerne [*R.A.M.*, xxii, p. 112], *P. arborescens* on opium poppy (*Papaver somniferum*) [ibid., xxv, p. 416], *Peronospora brassicae* on cabbage, radish, and swede, *P. gei* on *Geum chiloense*, *P. matthiolae* on *Matthiola incana*, *P. schleideni* [*P. destructor*] on onion, *P. spinaciae* on spinach, and *P. viciae-sativae* on vetch [ibid., xxii, p. 112].

Neergaard (P.). **Danish species of Alternaria and Stemphylium.**—560 pp., 70 figs., 67 diags., 20 graphs, Copenhagen, E. Munksgaard; London, Oxford University Press, 1945. [Danish and Esperanto summaries.]

The writer's exhaustive study of *Alternaria* and *Stemphylium* is described as a continuation of the attempts already made by J. A. Elliott (*Amer. J. Bot.*, iv, pp. 439–476, 1917), P. C. Bolle [*R.A.M.*, iv, p. 60], P. A. Young [ibid., vi, p. 111], and S. P. Wiltshire [ibid., xviii, p. 141] to provide a rational survey of the taxonomy and parasitism of these genera, and represents a further contribution to a monograph on the subject.

In order to determine the host range of individual species of the genera, monospore inoculation experiments were carried out on 36 plant species belonging to 14 families, the ten principal ones being wheat, onion, carnation, cabbage, peas, cucumber, *Godetia hybrida*, carrot, tomato, and lettuce: van Luyk's method, involving the use of seedlings raised from sterilized seeds on filter paper and distilled water in autoclaved test tubes [ibid., xviii, p. 47], was employed in a large number of the trials. *A. tenuis* auct. sensu strictu (the name retained as the designation of a group of forms usually described by this name in the mycological literature), syn. *Macrosporium caudatum* Cke & Ell. p.p., *M. seguerii* Allesch., *A. rugosa* McAlpine, *A. mali* Roberts, and *A. solani* (E. & M.) Jones & Grout *f. symphoricarpi* Davis [ibid., x, p. 669], is ubiquitous and its presence as a facultative parasite on

some 120 species of seeds was established. *A. circinans* (Berk & Curt.) Bolle (which in an addition to this work the author admits is antedated by *A. oleracea* Milbrath) is extremely prevalent on cabbage in Denmark [ibid., xxv, p. 378], where barely 10 per cent. of 746 lots of seed grown from 1935 to 1941 were found to be free of infection. The pathogen appreciably reduces seed production both qualitatively and quantitatively [ibid., xiii, p. 204]. Positive results were obtained in inoculation tests on onion, carrot, carnation, peas, and wheat.

A. resedae n. sp., first observed on *Reseda odorata* seeds in October, 1941 [ibid., xxiii, p. 427], was found to be present between that date and December, 1944, on eight out of 39 lots examined, the incidence of infection ranging from 1 to 28 per cent. Four of the contaminated lots were grown in Denmark, one in Czechoslovakia, one was imported from France, and two from Germany. It is characterized by olive-buff to dark olive-buff, closely septate, non- or sympodially-branching conidiophores, 30 to 50 by 4 to 6 μ; smooth, obclavate, conical, oval, or cylindrical, sometimes slightly curved, deep or dark olive-buff to buffy-brown conidia, produced in chains of up to 10 (usually 5 to 6 in agar cultures), furnished with 1 to 10 transverse and up to 3 longitudinal walls, and a beak measuring 2 to 28 by 2 to 4·5 (2 to 6 by 2 to 4·5) μ, almost invariably non-septate, rarely provided with up to 3 septa, the total length of the conidia, including the beak, being 9 to 66 μ and their width 6 to 15 μ. There is a considerable resemblance between the conidia of *A. resedae* and those of *A. circinans*, but they may be distinguished, e.g., by the greater symmetry, rather smaller cell dimensions, general absence of a beak, fewness of longitudinal septa, and darker coloration of the latter. The optimum temperature for mycelial growth in both species is 25° C. *A. resedae* retains its virulence in culture for a year, after which there is a steady decline, a 2½-year-old isolate having been found virtually non-pathogenic. Cabbage and *G. hybrida* contracted mild infection in inoculation tests with *A. resedae*.

G. hybrida was the only one of the ten main test plants to be attacked by *A. tenuissima* [ibid., xiii, p. 326], which is presumably a saprophyte or at most a facultative parasite of a very low order of virulence. However, a new variety of the species, var. *godetiae*, caused severe depredations in *G. hybrida* crops in Denmark from 1937 to 1941, reducing the seed yield of susceptible varieties like Kelvedon Glory and Sybil Sherwood to a fraction of the normal. It differs from the type in the larger and more frequent terminal swelling of the beak, the length of which may reach twice that of the conidial body instead of the same length, and in its cultural characters, as well as in its severe pathogenicity to *G. hybrida*.

A. dianthi [ibid., xxiii, p. 389] is of rare occurrence in Denmark, where it has been found on *Saponaria officinalis*, *S. vaccaria*, carnation, and *Dianthus barbatus* (seeds only of the two last-named). In inoculation experiments it also attacked *Gypsophila elegans*. On the other hand, *A. dianthicola* n. sp. [ibid., xxiii, p. 427] is common and severe on carnation, *D. barbatus*, and *D. plumarius*, causing the development of whitish- to faintly brownish-yellow, dark-bordered, usually oval spots, 5 to 10 mm. in length, sometimes confluent, forming areas several cm. in length on the stems, leaves, and buds, and producing immediately on the exposure of the petals dense olive-green patches of conidia, which render the flowers unsaleable and may reduce the profits on the crop by 5 to 20 per cent. From 1st April, 1941, to 1st December, 1944, it was isolated from 74 out of 192 lots of carnation and 3 out of 23 *D. barbatus* seed, originating in France, Holland, Germany, and Hungary. The writer thinks there has been widespread confusion in the past between *A. dianthi* and *A. dianthicola*, which may, however, be differentiated on the basis of the following characters. In the former the conidia are broader and shorter than in the latter (13·5 to 66 by 7·5 to 25·5 compared with 12 to 87 by 7·5 to 21 μ), the beak is much shorter (1·5 to 69 as against 9 to 99 μ), there are many more longitudinal septa (up to nine) in *A. dianthi* than in *A. dianthicola* (maximum of three), the conidia of the

former are darker coloured, the cultural features of the two species are quite distinct, and they also differ physiologically, the capacity of *A. dianthicola* for sporulation in culture persisting much longer than that of *A. dianthi*. *G. elegans* was infected by *A. dianthicola* in inoculation tests.

A. matthiolae n. sp. (antedated by *A. raphani* Groves & Skolko as noted in the 'addition' to this work, syn. *A. brassicae* (Berk.) Sacc. var. *macrospora* Sacc.) [ibid., xvi, p. 103] is extremely common on *Matthiola incana* and radish seeds of Danish, Dutch, German, and Hungarian origin (one lot of the former also imported from France). The fungus does not appear to be of great economic importance, though it probably impairs the germinative capacity of the seed, judging by the results of experiments on radish. Positive results were obtained in inoculation tests on cabbage, wallflower, *Iberis*, and lettuce. The principal morphological differences between *A. raphani* and the nearly related *A. brassicae* are the longer conidia and beak of the latter (33 to 147 and 9 to 148 μ compared with 12 to 78 and 3 to 76·5 μ); the rare formation of secondary conidia by *A. brassicae*, contrasted with the normal development of chains of two to four in *A. raphani*; the paler colour of the conidia of *A. brassicae* (deep to dark olive-buff compared with dark olive-buff to buffy-brown in *A. raphani*); and the absence in the former species of gemma formation, a characteristic feature of the latter. A close morphological similarity further exists between *A. raphani* and *A. dianthi*, important differences being the generally smaller and darker-coloured spores of the latter and their conical shape (those of the former are usually oval), and the absence of gemma formation in *A. dianthi*.

A. porri appears to have been only twice recorded in Denmark, in 1937 on onion seeds [ibid., xvii, p. 654] and in 1942 on leek foliage affected by a purple blotch resulting in a loss of 25 to 30 per cent. of the crop. These are believed to be the first observations of the fungus in Europe. Besides *Macrosporium porri*, the author regards *A. allii* Nolla [ibid., vi, p. 524] as a synonym of *A. porri*.

A. porri (Ell.) Saw. [see correction on p. 560] f. sp. *dauci* (Kühn.) n. comb., or in view of Groves and Skolko's paper *A. dauci* (Kühn) Groves and Skolko f. sp. *porri* (Ell.) n. comb. (*M.* [*A.*] *carotae*), is the agent of a destructive leaf spot of carrots in the United States [ibid., xxiv, p. 303], but in Europe it appears to be of little practical importance. Inoculation tests gave positive results on parsley, lettuce, celery, cabbage, cucumber, carnation, *Godetia hybrida*, tomato, radish, and eggplant. The fungus lost its virulence almost entirely in the course of three years' pure culture.

A. porri (Ell.) Neerg. f. sp. *solani* (E. & M.) n. comb. or *A. dauci* (Kühn) Groves & Skolko f. sp. *solani* (E. &.M.) n. comb. (syn. *A. solani* (E. & M.) Jones & Grout, *Sporodesmium solani-varians* Vañha, etc.), does not ordinarily cause heavy reductions in the Danish potato yield owing to the relatively late development of infection [ibid., xxiv, p. 469], and for the same reason it is of no great importance on tomatoes. Inoculations were successful on chilli, *Capsicum globatum*, tomato, eggplant, carrot, cabbage, carnation, onion, cucumber, lettuce, *G. hybrida*, *Ageratum houstoniarum*, *Nicotiana sanderae*, *Papaver paeoniflorum*, and *Zinnia elegans*. In pure culture the virulence of the fungus declined from the second to the fifth year.

Alternaria zinniae Pape [ibid., xxii, p. 389] has been observed annually on *Z. elegans* in Denmark since 1937, its intensity varying considerably with climatic factors. Other natural hosts include *Callistephus chinensis*, *Chrysanthemum corinatum*, *Cosmos bipinnatus*, *Helianthus debilis*, and *P. alpinum*, while among those artificially infected were lettuce, *G. hybrida*, tomato, and *N. sanderae*.

A. anagallidis, described by Raabe from the vicinity of Tübingen, Germany [ibid., xviii, p. 140], was found by the writer on *Anagallis arvensis* and its var. *coerulea* in the Copenhagen Botanical Garden in 1942. The conidia of the fungus are very similar to those of *A. porri*, but the spore body of *A. anagallidis* is considerably shorter (13·5 to 81 μ).

A. anagallidis var. *linariae* n. var., was found attacking *Linaria maroccana* and *Antirrhinum majus* seeds in the germinator and was weakly pathogenic in inoculation tests on cabbage, *G. hybrida*, lettuce, tomato, *N. sanderae*, and *P. paeoniflorum*. It differs from the type in its conidial dimensions (37·5 to 289·5, inclusive of beak, by 9 to 21 μ). One of the five isolates was still virulent after three years' culture.

Alternaria linicola n. sp. (antedated by *A. linicola* Groves & Skolko) was first detected in 1940 on non-germinating seeds of *Linum grandiflorum rubrum* imported from France, and subsequently reported by Miss Johansen under the designation of *A.* (?) *solani* [ibid., xxiv, p. 451]. It is distinguishable from *A. anagallidis* by its longer conidia (39 to 292·5 μ, inclusive of beak), from *A. porri* by its smaller conidial dimensions, and from *A. lini* Dey [ibid., xiii, p. 239] by its single conidia, those of the Indian species being concatenate.

The percentage of infection in seven lots of cineraria seeds by *A. senecionis* n. sp. ranged from 1·3 to 29·5 per cent. Two of the lots were imported from France and Germany, respectively, while the others were home-grown. *A. senecionis* differs from *A. raphani* in its conidial dimensions (40·5 to 187·5, inclusive of beak, by 10·5 to 48 μ) and absence of a tendency to gemma formation, and from another closely similar species, *A. brassicae*, in the greater width of its conidia and shorter beak (10·5 to 85·5 μ). Inoculation experiments gave positive results on lettuce, cucumber, *G. hybrida*, and tomato, only the first-named, however, reacting to any extent.

A. gypsophilae n. sp. was first detected in 1938 on *Gypsophila elegans* seeds and seedlings suffering from damping-off in the germinator, since when it was repeatedly isolated from seeds of the same species and from three lots of *G. paniculata*, two imported from Holland and one from France. In 1944 it was found in 19 lots of *G. elegans* seed, including one imported from Germany. Differences between *A. gypsophilae* and the allied *A. dianthi* include the modes of conidial production—single in the former and concatenate in the latter—and the narrower conidia with longer beaks of *A. dianthi*. In *A. gypsophilae* the buffy-, olive-, or natal-brown conidia measure 22·5 to 118·5 (inclusive of beak) by 9 to 27 μ. The virulence of two isolates persisted in culture for four years. Carnations were artificially infected by *A. gypsophilae*. *M. nobile* Vize apud Cooke sensu E. Rostrup (1902) is probably identical with this species. *A. cheiranthi* (Fr.) Bolle sensu Wiltshire [ibid., xiii, p. 326] was isolated from 45 samples of wallflower seed between 1st April, 1936, and 1st January, 1944, of which 26 were grown in Denmark, 12 imported from Holland, five from Germany, and one each from England and France. *A. gypsophilae* resembles this species, but the conidia of the latter tend to be considerably wider and more irregular in form. *A. cheiranthi* was successfully inoculated into white cabbage, *I. amara*, radish, and *M. incana*. It was still sporulating after 2½ years in pure culture.

Stemphylium ilicis Tengwall [ibid., iv, p. 60] (*M. abietis* Tengw., *S. congestum* Newton [ibid., vii, p. 789], *S. dendriticum* de Souza da Camara [ibid., ix, p. 687]) is a common saprophyte or facultative parasite which was found by the author in Denmark on 45 species of seeds: it is also prevalent in the same country as the agent of a cucumber leaf spot, in which form it is known as *Sporodesmium pluriseptatum* (Karst. & Har.) Peck (*S. mucosum* Sacc. var. *pluriseptatum* Karst. & Har.) [ibid., xvi, p. 652], a name it is considered advisable to retain pending further clarification of the taxonomic problems involved in its designation. The fungus showed no perceptible impairment of its sporulating capacity after 20 years' pure culture. Cabbage, *Godetia hybrida*, lettuce, and tomato were among the plants attacked in inoculation tests.

M. daucinum Yatel (*J. Microbiol., Ukraine*, v, 2, pp. 195–214, 1938) is stated to be identical with *Stemphylium radicinum*, and *M. arnicae* Rostrup 1905 with *S. botryosum*.

The distribution, economic importance, physiology, pathogenicity, duration of virulence, and control of the various species of *Alternaria* and *Stemphylium* are also discussed.

OSTER (G.) & STANLEY (W. M.). **An electron microscope study of the contents of hair cells from leaves diseased with Tobacco mosaic virus.**—*Brit. J. exp. Path.*, xxvii, 4, pp. 261–265, 1 fig., 1 graph, 1946.

Electron micrographs, prepared by the gold shadow-casting technique, of the contents of hair cells from the leaves of Turkish tobacco plants infected by the tobacco-mosaic virus [*R.A.M.*, xxv, p. 437] revealed rod-like particles, of which 68 per cent. measured about 280 mμ by 15 mμ. Similar micrographs of normal tobacco leaf hair cells showed no such structures. It seems reasonable to conclude, therefore, that these rods, which have been found to represent the minimal infective units of the virus, occur within the cells of mosaic-diseased tobacco plants. These data do not support Bawden and Pirie's suggestion [ibid., xxv, p. 188] that the primary virus particle is small and not appreciably elongated.

CLAYTON (E. C.). **Blue mould control in Tobacco beds.**—*Publ. U.S. Dep. Agric.* AIS 37, 7 pp., 3 figs., 1945.

Detailed directions are given of gas [*R.A.M.*, xxiii, p. 505], spray, and dust treatments for the control of blue mould of tobacco [*Peronospora tabacina*]. Paradichlorobenzene is still recommended for the first. Fermate (1½ lb. in 50 gals.) and bismuth subsalicylate (12 oz. in 50 gals.) [ibid., xxii, p. 410] sprays, each with 8 oz. vatsol O.T.C. or 4 oz. vatsol K as wetting agents, are more commonly used at present than the yellow cuprocide (8 oz. in 50 gals.) preparation plus 8 to 12 oz. vatsol O.T.C. or 4 to 6 oz. vatsol K and 2 qts. cottonseed oil [loc. cit.], first suggested for the control of blue mould. For the dust treatment, 7½ lb. fermate plus 42½ lb. pyrax (pyrophyllite) as filler is prescribed. The bismuth spray is said to have more lasting effects than fermate.

KIGHTLINGER (C. V.). **Black root-rot resistant strains of Havana seed Tobacco for the Connecticut Valley.**—*Bull. Mass. agric. Exp. Sta.* 432, 20 pp., 4 figs., 2 diags., 1946.

The various strains of Havana seed tobacco have characteristics sufficiently similar to distinguish this type of seed from others and at the same time are easily susceptible of differentiation as between one another. Susceptibility to black root rot (*Thielaviopsis basicola*) [*R.A.M.*, xxv, p. 189] varies in the majority from moderate to severe, relatively few show high resistance, and none is immune.

The author's observations since 1930 show *T. basicola* as one of the most virulent diseases of Havana seed tobacco in the Connecticut Valley. Its development is mainly determined by the degree of infestation of the soil by the organism, soil reaction, moisture, and temperature, and the relative susceptibility of tobacco to the pathogen. A relatively low soil acidity value favours, and relatively high acidity discourages, the development of black root rot. At pH 6 and above the disease usually causes more or less damage to tobacco in the Connecticut Valley; it is rarely serious below pH 5·6, and is unlikely to develop at 5·2 or lower. The organism grows at soil temperatures between 10° and 40° C., is able to infect tobacco between 15° and 32°, and severe attack occurs between 18° and 23°. High soil moisture near saturation point favours pathogenicity; below saturation point little effect on the development of the disease is observed; but the more the soil temperature is lowered through evaporation of moisture, the more dangerous *T. basicola* becomes.

In breeding for the production of new resistant strains, both parents were selected from Havana seed stock, respectively highly resistant and highly acceptable

in type and quality. Two of the new strains produced, Havana 211 and a later strain, K2, appeared to be worth continuation. The former was bred in Wisconsin from a cross of the resistant, but coarse, Page's Comstock and Havana 38, an improved strain of regular Havana seed. Havana K2 was bred and developed in Massachusetts from a strain of regular Havana seed known as Sandman and Havana 211. Both strains gave better results than regular Havana seed, both in conditions favouring the disease and in conditions favouring tobacco production. Havana 211 has proved able to produce tobacco of good type and quality in large enough amounts to be profitable in the Connecticut Valley. Havana K2 may not be so successful.

RICHARDS (M. C.) & BARRATT (R. W.). **A partial survey of the genus Lycopersicon for resistance to Phytophthora infestans.**—*Plant Dis. Reptr*, xxx, 1, pp. 16–20, 1946. [Mimeographed.]

Plants of 70 strains of the edible tomato, 18 of *Lycopersicon pimpinellifolium*, 7 of *L. hirsutum* and one of *L. hirsutum* var. *glabratum*, two, respectively, of *L. esculentum* var. *pyriforme* and *L. esculentum* var. *cerasiforme*, one each of *L. peruvianum* and its var. *humifusum*, and *L. chilense*; the following hybrids, PI 114,969 *L. esculentum* × *L. pimpinellifolium*, Early Chatham × *L. hirsutum* (PI 127,826) F_1, F_2 selections of *L. peruvianum* (PI 129,946) × Michigan State, (*L. hirsutum* × Victor) × Early Chatham, (*L. hirsutum* × Victor) × Victor, and Early Chatham × Pennheart, and John Baer × Victor F_4 selections; and 28 commercial varieties were tested for reaction to *Phytophthora infestans*. The results are tabulated. Under optimum conditions for inoculation and infection all the 137 species and selections proved highly susceptible. Conidial production was not common on the leaves, even when plants were severely attacked and under favourable conditions, as shown by the prolific sporulation on the potato plants used as controls. Leaves of *L. chilense* showed abundant conidial production, and some commercial varieties also.

While varietal resistance to P. *infestans* may be shown within the genus *Lycopersicon*, notably in the field, where conditions may not always favour infection, none of the plants tested exhibited high resistance to, or immunity from, the late-blight pathogen.

KREUTZER (W. A.) & BRYANT (L. R.). **Certain aspects of the epiphytology and control of Tomato fruit rot caused by Phytophthora capsici Leonian.**—*Phytopathology*, xxxvi, 5, pp. 329–339, 1 fig., 1946.

In further studies at the Colorado Agricultural Experimental Station on tomato fruit rot (*Phytophthora capsici*) [*R.A.M.*, xxiv, p. 124], which again caused losses estimated at 10 to 25 per cent. of the crop in the Arkansas River Valley in 1945, sporangia developed in profusion within 48 hours at 25° C. on 20- to 60-day-old giant barley cultures ground and mixed with well-moistened, non-steamed field soil. Sporangia were not produced at or below 18° or at 35°, but within the range from 20° to 30° they were formed in abundance, with an optimum at 25°. A soil temperature between 65° and 85° F. is the prerequisite condition for the development of a fruit-rot epidemic, though plentiful moisture is also an essential factor.

The addition of water to soil inoculum held at 25° C. for 48 hours resulted in zoospore production reaching a climax in two to three hours at the same temperature. The earliest infection of unwounded green tomatoes occurred after one hour's exposure to drops of inoculum containing zoospores at 25° and 30°, and a peak was reached after three hours at these temperatures. At 10° a period of five hours was required to induce infection.

Of 120 varieties, lines, and types of tomato tested in the field, only a few (including the Porter variety) showed any promise of resistance.

The information presented in this paper on the control of the fruit rot has already been noticed from another source [ibid., xxiv, p. 477].

BAKER (K. F.). **An epiphytotic of Rhizopus soft rot of green-wrap Tomatoes in California.**—*Plant Dis. Reptr*, xxx, 1, pp. 20–26, 1946. [Mimeographed.]

Old and badly infested picking-boxes in which fruit had previously been allowed to decay [*R.A.M.*, iii, p. 143; xii, p. 121; xxiv, p. 106] were found responsible for the outbreak in a Californian packing-house in 1944 of a soft-rot disease caused by *Rhizopus nigricans* [*R. stolonifer*]. The reutilization of these containers provided the primary inoculum, which was increased rapidly as a result of the commercial practice of holding sub-grade fruit in the same building to ripen for local markets instead of disposing of it promptly.

It was found that infection took place only through wounds, though these might have dried for at least four hours prior to inoculation. Mycelial spread from adjacent decayed fruit was not dependent on the presence of wounds.

For the extermination of the fungus in the boxes it was found necessary to use dry heat at 300° F. for one hour or to heat freshly wetted boxes to 200° for two hours. Dry air at 250° for one hour reduced the populations of *R. stolonifer*, but lower temperatures proved ineffectual even after three hours.

WALKER (J. C.), WHIPPLE (O. C.), JOLIVETTE (J. P.), & HOOKER (W. J.). **The limitations of spraying Tomatoes in Wisconsin.**—*Res. Bull. Wis. agric. Exp. Sta.* 152, 23 pp., 7 figs. 1944.

As a result of experiments carried out annually from 1937 to 1942 and designed to test the efficacy of spraying tomatoes for control of early blight (*Macrosporium* [*Alternaria*] *solani*) and leaf spot (*Septoria lycopersici*) [*R.A.M.*, xxiv, p. 293 *et passim*] in southern Wisconsin, where a limited area is planted for canning, it is concluded that in these localities and also in those north of them, little economic increase of yield can be expected from spraying the plants. Improved quality has not been forthcoming. No differences measurable in yield or quality followed trials of various insoluble copper compounds including copper oxychloride sulphate, cupro-potassium oxychloride, cuprocide, and cuprocide 54, though they proved less toxic than Bordeaux mixture.

The investigation did, however, show that tomatoes are too commonly grown on soil insufficiently fertile to give maximum yields. When plants are well nourished, the benefits of foliage protection diminish and, conversely, better results are secured by spraying plants on soils of low fertility than richer ones. Improved quality of fruit was much greater when nutrients were added to the soil than when fungicidal applications were made.

SCHROEDER (W. T.) & SMITH (F. G.). **Preliminary experiment indicates that 2, 4-d (2, 4-dichlorophenoxyacetic acid) treatment of Tomato may reduce losses due to fruit crack molds.**—*Plant Dis. Reptr*, xxx, 6, pp. 197–199, 1946. [Mimeographed.]

Failure of fungicidal sprays to control effectively the loss of tomato fruits through mould invasion of cracks during the rainy latter part of the season has caused concern among canners in New York State. An experiment, intended primarily to test the effect of certain synthetic growth hormones on the ripening of tomato fruits, happened, however, to demonstrate the value of 2, 4-d (2, 4-dichlorophenoxyacetic acid) in reducing the number of fruit cracks and subsequent mould development. After treatment with 2, 4-d at 1,000 p.p.m., of 317 tomato fruits, the percentage of ripe fruit was 98·4, of which 6·5 was sun-scalded and 9·4 cracked, as against (for 298 fruit in the controls) 92·6, 4·1, and 73·9, respectively. Thus, while the amount of cracked fruit was much less in the plots treated with 2, 4-d, there

was little difference in the incidence of sun scald or in the degree of ripeness. All the tomatoes in the plots sprayed with 2, 4-d were firm and fit for canning, apart from a heavy attack of anthracnose [*Colletotrichum phomoides*].

NICHOLAS (D. J. D.), JONES (J. O.), & WALLACE (T.). **Experiments on the control of magnesium deficiency in glasshouse Tomatoes. Progress Report III.**—*Rep. agric. hort. Res. Sta. Bristol, 1945*, pp. 80–94, [? 1946].

As a result of experiments carried out in 1945 [*R.A.M.*, xxv, p. 15] on the control of magnesium deficiency in tomatoes, it is recommended that four or five 1 or 2 per cent. sprays of magnesium sulphate at intervals of three weeks throughout the growing season are recommended for complete control, although three 2 per cent. sprays during the early growth stage were equivalent in effect. A trial application should be made to a few plants 48 hours before the main spraying to ascertain whether spray injury is likely to develop. One early spray was found useful in delaying the onset of magnesium deficiency symptoms and a second late in the season arrested their development. Sunny conditions should be chosen for spraying. A spreader, e.g., sulphonated lorol at 10 oz. per 100 gals. [ibid., xxv, p. 292] must be used. Commercial control, not, however, so effective as that afforded by spraying, was again secured by incorporating 10 cwt. magnesium sulphate (calcined kieserite 30 per cent. magnesium oxide) in the base dressing. No advantage accrues from increasing this amount and such applications had little effect on the incidence of the deficiency the following season.

DAY (W. R.). **The pathology of Beech on chalk soils.**—*Quart. J. For.*, xl, 2, pp. 72–82, 1946.

The author describes the development and symptoms of lime-induced chlorosis in beech trees growing on shallow, usually well-drained calcareous soils in England. Owing to the physical and chemical nature of the soil, adverse water conditions occur in dry seasons, and the iron present is rendered inactive. The inability of the trees to utilize the iron causes chlorosis. This in turn prevents the growth and maintenance of an adequate root system. Die-back of the crown and root sets in, predisposing the trees to bark disease associated with *Nectria punicea* and to root decay and butt rot caused by *Ustulina vulgaris* [*R.A.M.*, xxii, p. 157]. The evidence available also indicates that other adverse soil conditions (probably generally associated with drought) induce the death of the roots and predispose trees to butt rot, even if no chlorosis is present.

BRENY. **Dothichiza populea.**—*Bull. Soc. for. Belg.*, liii, 6–7, pp. 284–288, 1946.

During 1946 poplar nurseries and young poplar plantations in Belgium have been widely affected by *Dothichiza populea* [*R.A.M.*, xi, p. 338]. Preventive treatment is recommended by appropriate cultural methods [cf. ibid., xxii, p. 183] and fungicidal and insecticidal spraying, while surgical methods should be adopted curatively.

MARTIN (J. F.). **Spread of White Pine blister rust during 1945.**—*Plant Dis. Reptr*, xxx, 6, pp. 204–206, 1 map, 1946. [Mimeographed.]

The spread of blister rust (*Cronartium ribicola*) [*R.A.M.*, xxv, p. 375] has been noted during 1945 in northern California east into the southern Warner Mountains, where it was encountered for the first time on *Ribes petiolare* in the Modoc National Forest. *Ribes* infection was observed for the first time in 22 counties of the four States of Illinois, Indiana, Iowa (12 counties), and Ohio, and infected white pines were found for the first time in Crawford and Ogemaw Counties, Michigan. Two centres of white pine infection found in Grayson County are first records for south-western Virginia, and a three-acre area of infection apparently

dating from 1936, in Ashe County, North Carolina, constitutes the most southern known infection centre in the region and the first record of the disease for North Carolina. Blister rust was reported for the first time from Anne, Arundel, and Cecil Counties, Maryland, on cultivated *Ribes*.

ETTLINGER (L.). **Über die Gattung Crumenula sensu Rehm mit besonderer Berücksichtigung des Crumenula-Triebsterbens der Pinus-Arten.** [On the genus *Crumenula* sensu Rehm, with special reference to the *Crumenula* die-back of the shoots of *Pinus* species.]—Thesis, Federal Technical College, Zürich, 73 pp., 4 pl. (1 col.), 12 figs., 4 graphs, 1945.

In the Swiss Alpine forest plantings visited by the author the forms assumed by *Crumenula abietina* on pines [*R.A.M.*, xxiii, p. 200] presented certain anomalies in comparison with material from Denmark [ibid., xx, p. 41] and descriptions. They do not, however, transcend the limits of physiologic race differences, and the erection of a new species is accordingly not proposed. It is suggested, however, that the diagnosis of *Brunchorstia pinea* (Karst.) v. Höhn. be amended to include 0- to 9-(mostly 3- to 7)-septate spores, 15 to 57 μ in length.

In pure cultures on malt agar a strain of *C. abietina* from Davos made almost twice as much growth as the Danish isolate supplied by the Bureau voor Schimmelcultures, Baarn, at various temperatures from $-3°$ to $21{\cdot}5°$ C., above which point the Danish strain ceased to grow, although it resumed development on transference to laboratory temperature, while the former grew at $24{\cdot}9°$ but was apparently killed at $27{\cdot}9°$. The optimum for both was $18{\cdot}9°$. The activity of the Swiss parasite reaches a climax in the cold season and its rate of growth in culture corresponds to that necessary for the involvement of an entire current year's shoot. Under Alpine conditions the interval between the melting of the snow and leafing is very short, and since at 0° the growth rate of the mycelium in culture was about a quarter of its maximum velocity, it is possible that its parasitic activity may persist throughout the winter beneath the snow cover.

Morphological and taxonomic studies on *C. pinicola* [ibid., xvi, p. 136], *C. sororia* Karst., and *C. abietina* led to the conclusion that the three species are distinct. According to Karsten (1871), the asci of *C. pinicola* measure 60 to 70 by 12 to 14 μ and the ascospores 18 to 32 by 3 to 4 μ, the corresponding dimensions of *C. sororia* being 100 to 110 by 10 to 12 and 12 to 18 by 3·5 to 5 μ, respectively. The measurements of the Danish and Swiss specimens of *C. pinicola* examined by the writer agreed exactly with Karsten's data. Rehm's relegation of *C. sororia* to synonymy with *C. pinicola* (Rabenhorsts Kryptogamenfl., 2. Aufl., III Abt., pp. 236–237, 1896; *Ber. bayr. bot. Ges.*, xiii, p. 193, 1912) suggests that he was entirely unfamiliar with the former species and had at his disposal only herbarium material of the latter. *C. abietina* differs from *C. sororia* mainly in its triseptate spores, those of the latter being predominantly non-, rarely uni- to triseptate. The fruit bodies of *C. sororia*, moreover, are pilose, notably at the periphery, and thus present a closer similarity with *C. pinicola* than the scaly-smooth apothecia of *C. abietina*. The fungus observed by Guyot on pine in France, with characters intermediate between those of *C. sororia* and *C. pinicola* [*R.A.M.*, xiii, p. 665], seems to agree best with the former species both in its morphology and symptomatology, as described by Ferdinandsen and Jørgensen [ibid., xviii, p. 212]. *C. sororia* has not yet been observed in Switzerland.

A fuller description is given of *C. laricina* n. sp. [cf. ibid., xxiii, p. 200], the agent of a die-back and needle-fall of larch shoots in the Swiss Alps. The asci are sessile, elongated, round-tipped, 63 to 118 by 5 to 9 μ, containing eight hyaline, elliptical to fusiform, obtuse-ended, straight, uniseptate ascospores, 10 to 17 by 3 to 4 μ. Filiform, septate, mostly branched paraphyses, with thickened or peculiarly lobate tips, project slightly above the asci. The pycnidia of *B. laricina* n. sp., the im-

perfect state of the foregoing, rupture irregularly at maturity and exude chamois-coloured, mucilaginous, simple or indistinctly septate, stromatoid pycnospores; the inner pycnidial walls are densely clothed with septate, branched conidiophores, from the apices of which are abstricted hyaline, uniseptate conidia, 14 to 23 by 3 to 4 μ. *C. laricina* differs from *C. pinicola* in its oblong ascospores, and from the nearly related *C. abietina* and *C. sororia* in the septation and larger length-to-width ratio of the ascospores, as well as in other dimensions. A further distinctive feature of *C. laricina* is its smaller apothecia with their smooth, sharp edges. The straight, uniseptate conidia of *B. laricina* are readily differentiable from those of *B. pinea*.

The optimum temperature for the growth of *C. laricina* on malt agar was about 12°, with a minimum between −5·8° and −3° and a maximum between 21·4° and 24·5°. Not only is the development of *C. laricina* slower than that of *C. abietina*, but the aerial mycelium of the former is higher and denser and the prevailing shade of colour more grey than green. *C. laricina* also fructified more readily than *C. abietina* in culture. Inoculation experiments with *C. laricina* gave negative results, so that the parasitism of the fungus could not be definitely proved. Its probability rests on the exclusive presence of the pathogen on diseased branches, the consistent procurement of the fungus in pure culture from fresh tissue isolations, and the macroscopic and microscopic resemblances of the symptoms of the larch die-back to those of the other *C.* spp. on pines.

The nomenclature and taxonomy of the genus *Crumenula* are discussed. The name *Crumenula* has been dismissed as illegitimate by Nannfeldt [ibid., xi, p. 106], Guyot [ibid., xiii, p. 665], and Groves [ibid., xvi, p. 136], but the author prefers to retain it, adopting Rehm's emendation (Rabenhorst, Discomycetes, p. 235) and including in the list of nomina conservanda *Crumenula* de Not. emend. Rehm.

In a brief appendix the systematic position of *B. gibbosa*, evidently a pure saprophyte, is discussed. The species is readily separable from *B. pinea* by the spore measurements (notably the much greater length of *B. gibbosa*) and mode of curvature, which in *B. pinea* is accentuated in the middle of the conidium and in *B. gibbosa* at either end. The septa are narrower in *B. gibbosa* than in *B. pinea*, and a further difference consists in the varying reactions of the cells of the two species to staining with cotton blue, those of *B. pinea* assuming a uniform tint while those of *B. gibbosa* are densely filled with oil drops.

LEUTRITZ (J.). **A wood soil contact culture technique for laboratory study of wood-destroying fungi, wood decay and wood preservation.**—*Bell Syst. tech. J.*, xxv, 1, pp. 102–135, 4 figs., 1 diag., 5 graphs, 1946.

The soil-contact method herein described was found to be a valuable laboratory adjunct for the study of fungal destruction of cellulose and wood and for the determination of the efficacy of wood and cellulose-preservatives [*R.A.M.*, xxiii, p. 246; xxv, p. 376].

Top soil with a 20 to 25 per cent. moisture content on a dry-weight basis, used as a substratum for decaying pine wood blocks, proved to be an excellent means of controlling the moisture content of the wood during the decay process. The optimum moisture content for the initiation of wood decay was fibre saturation. The initial water content of the wood remained constant during disorganization through maintenance of a constant volume of the wood structure, notwithstanding the loss of wood substance.

Investigation of the addition to the soil of various combinations of nutrients and 'nutrilites' (compounds necessary to fungus nutrition, e.g., vitamins, growth substances, and mineral salts, as defined by R. J. Williams in *Science*, N.S., xvii, p. 607, 1928) showed the importance of these materials in decay. The need for nitrogen by fungi causing destruction of cellulose, demonstrated by Schmitz and Kaufert [*R.A.M.*, xvi, p. 358], was confirmed. A comparison of the results obtained

with nutrient artificial soils and an average top soil indicated the possibility of using the former in the contact test method.

The optimum temperature for *Poria incrassata, Polyporus vaporarius* [*Poria vaporaria*], *P. microspora* [ibid., xxii, p. 506], and B(ell) T(elephone) L(aboratories) U–11 was 26° to 28° C., but *Lentinus lepideus, Lenzites sepiaria*, and *L. trabea* (BTL/U–40) caused considerable decay at 35°. *Merulius lacrymans*, on the other hand, was responsible for an average reduction in weight of 34 per cent. after six months at 21° compared with only 7 per cent. at 26° to 28° [cf. ibid., xiii, p. 413]. Decay occurred over a wider temperature range and was much more uniform and rapid in soil-contact than in Petri-dish tests or other laboratory methods or in field trials.

Petri-dish assays of preservatives were often misleading. In general, higher retentions were necessary to prevent decay than were indicated by this technique, but occasionally a material giving poor results in the Petri-dish trials acted as a satisfactory preservative of cellulosic derivatives both in soil-contact and field tests. Comparisons between the soil-contact assay and field trials of wood preservatives corroborated the closer approximation of the former to the optimum conditions for decay and the consequent exceptional severity of the tests thereby imposed on the experimental products. The soil-contact method may, in short, be applied to a wide range of materials, including leather, cotton, felt, paper, and jute with the assurance that any preservative preventing decay by this laboratory test, and permanently retained, will be effective under any climatic conditions.

Fire resistant treatment combats fungal decay.—*Timb. News Sawm. Engnr*, liv, 2080, pp. 58–59, 1 fig., 1946.

Tests were recently carried out at the Forest Products Research Laboratory, Princes Risborough, on behalf of the Timber Fireproofing Co., Ltd., to determine the resistance to fungal decay of wood treated by the oxylene process, involving impregnation with a mixture of monoammonium phosphate and borax. The fungi used for the Scots pine tests were *Lentinus lepideus, Coniophora cerebella* [*C. puteana*], and *Poria vaporaria*, and for those on beech, *Polystictus versicolor* and *P. sanguineus* (the latter an active agent of hardwood rot in the tropics). The samples, measuring 5 by 2·5 by 1·5 cm., were exposed for three months to attack by the test organisms on an agar medium in culture flasks in an incubator at 22° C., some being previously sterilized by autoclaving or oven-drying to kill adherent mould spores. At the close of the test period none of the oxylene-treated blocks showed any trace of fungal decay, and only the unsterilized samples in contact with *L. lepideus* were slightly mouldy, whereas all the controls were rotten, disorganization in the case of *C. puteana* being complete.

McFarland (W. H.). **The fungicidal properties of DDT.**—*Sth. Lumberm.*, clxxii, 2163, p. 48, 1946.

Laboratory experiments were carried out to determine the efficiency of dichloro diphenyl trichloroethane in the control of the wood-destroying fungi, *Fomes annosus* (Madison 517 strain), *Lenzites trabea, Trametes serialis*, and *Poria incrassata*. The compound was only slightly toxic to these organisms and it cannot be recommended as a timber preservative.

Kinberg (W.). **Jahresbericht 1944 (9te Folge) über Holzschutz gegen Holzpilze, tierische Schädlinge und Feuer.** [Annual report for 1944 (9th series) on wood preservation against lignicolous fungi, animal pests, and fire.]—107 pp., Stockholm-Vendelsö, 1945. Kr. 17·50. [Mimeographed.]

Particular interest attaches to the present instalment of the writer's valuable annual compilation of the literature and patents relating to the ravages and control

of wood-destroying fungi and other agencies, since it comprises many references to periodicals, treatises, and the like published during the war years of 1939 to 1944 and now (1945) available for the first time in Europe.

Groves (J. W.) & Skolko (A. J.). **Notes on seed-borne fungi. IV. Acremoniella, Chlamydomyces, and Trichocladium.**—*Canad. J. Res.*, Sect. C, xxiv, 3, pp. 74–80, 3 pl., 1946.

In this paper [cf. *R.A.M.*, xxiv, p. 42] the authors describe and figure the following fungi isolated from agricultural seed received at Ottawa: *Acremoniella atra* from onion, beet, carrot, red fescue (*Festuca rubra*), rye grass (*Lolium perenne*), parsnip, pea, radish, alsike clover (*Trifolium hybridum*), and maize; *A. verrucosa* from pea seed from Ontario and *Taraxacum kok-saghyz* from U.S.S.R.; *Chlamydomyces palmarum* from parsnip and pea; and *Trichocladium asperum* from pumpkin, carrot, lettuce, pea, and broad bean (*Vicia faba*). These fungi do not appear to have any great pathological significance.

Studies on vegetable seed treatments in 1944.—*Plant Dis. Reptr, Suppl.* 161, 66 pp., 1946. [Mimeographed.]

Two hundred and thirty-six uniform seed-treatment tests on ten vegetable crops (soy-beans, beets, carrots, cucumber, lettuce, onions, peas, spinach, sweet corn [maize], and tomato) undertaken by 40 workers in 29 States of the American Union and two Canadian Provinces in pursuance of the co-operative project fostered by the American Phytopathological Society in 1940 are surveyed in this supplement [cf. *R.A.M.*, xxv, p. 379].

R. H. Porter reports that seed-protectants were of some value in about one-third of the tests conducted with Banzei soy-beans in 14 States. Spergon at 2 oz. per bush. gave the most consistent increases in emergence. Under unfavourable conditions for germination, the value of seed-protectants was demonstrated even with high-vitality seed; the benefit for low-vitality material should therefore be greater.

L. D. Leach records significant increases in Detroit dark red beet seedlings in 31 tests in 20 States and one Canadian Province, using arasan (0·25, 0·5, and 1 per cent.), ceresan (1 per cent.), and yellow cuprocide (1·5 per cent.), as compared with untreated seed. Strikingly successful treatments in the 1944 tests compared with results in 1943 reflect differences in vitality and susceptibility to seed decay in the seed lots employed. Weak lots may show better response to seed-protectants than vigorous lots or varieties.

According to reports by B. H. Davis on 19 tests in 15 States and one Canadian Province, arasan (0·5 and 0·75 per cent.) gave rather better increases than spergon at similar dosages, semesan (0·42 per cent.), and red copper oxide and zinc oxide both at 1 per cent. for the Chantenay variety of carrot.

Under field conditions in 1944, less favourable than in the preceding year, semesan and spergon (both at 0·3 per cent.) proved to be the most effective seed-protectants of cucumbers in 12 States according to S. P. Doolittle and F. S. Beecher. Spergon gave much better results than in 1943, but arasan did not maintain its primacy recorded in that year.

G. K. Parris reports that lettuce seed was successfully treated in eight States with red copper oxide, zinc oxide, semesan, arasan, and spergon, all at 2 per cent., the last-named giving the best protection and all proving superior to untreated seed.

Arasan and fermate at 0·5 and 1 per cent., respectively, and semesan at 0·3 and 0·5 per cent., protected onion seed in one-third of the 11 damping-off tests of Yellow Globe onion seed carried out in eight States, according to A. G. Newhall. He reports good control of smut [*Urocystis cepulae*] in two tests by moistening the

seed with 5 per cent. methocel sticker and treating with arasan, fermate, or thiosan, each at 100 or 75 per cent. by weight, the higher concentration proving slightly better.

Spergon at $1\frac{1}{2}$ and 2 oz. induced the best germination of Thomas Laxton peas in 53 tests in 22 States and one Canadian Province; red copper oxide at $2\frac{1}{4}$, and arasan at $1\frac{1}{2}$ and 2 oz. per bush. gave good results according to the reports of W. T. SCHROEDER.

G. K. PARRIS records confirmation of improved stands of spinach in 36 tests in 25 States and one Canadian Province due to seed treatment with arasan at 0·25 and 0·5 fermate at 0·5 and 0·75 and zinc oxide at 1·5 and 2 per cent., the last-named proving consistently best even at the lower dosage.

Arasan, spergon, semesan jr., and barbak C at 1·5 and 3 oz. per bush. all gave higher seedling production and reduction in weaklings over untreated seed of Ioana sweet corn, according to B. H. DAVIS's report of 30 tests in 19 States and one Canadian Province. Arasan proved best, with decreasing effectiveness of the rest in the order given above, the higher dosage giving the most successful results.

S. P. DOOLITTLE and F. S. BEECHER show that in only 42 per cent. of 12 tests in 10 States were improved stands of tomato obtained by using spergon, arasan, and semesan, all at 0·3, yellow cuprocide at 1·5, and new improved ceresan at 0·5 per cent., and as a five-minute dip in a 1 in 1,200 solution. In the beneficial treatments arasan proved best, but semesan, yellow cuprocide, and new improved ceresan were satisfactory. As in 1943, spergon was less effective for tomato seeds. New improved ceresan was equally good in dust form or as a dip.

SNYDER (W. C.). **Spermogonia versus pycnidia in Mycosphaerella brassicicola.**—*Phytopathology*, xxxvi, 6, pp. 481–484, 1 fig., 1946.

In the winter of 1945 an examination at Berkeley, California, of numerous ring spot-infected cabbage leaves from field plants revealed the presence of pycnidium-like bodies and an exudate corresponding to those previously described in connexion with the imperfect state of *Mycosphaerella brassicicola* [*R.A.M.*, v, p. 459]. In germination tests, using a mixed suspension of the exudate and ascospores from the perithecia produced on dead, infected leaves the ascospores germinated in all tests within 24 hours, whereas none of the supposed pycnospores made any growth in a week. In 20 inoculation experiments with ascospores and the same number with the exudate, typical ring spot developed on the detached cabbage leaves only from ascospore inoculum incubated in the open. When 20 mono-ascospore cultures and 20 from the exudate were placed out of doors, all the former produced colonies which in time gave rise to the so-called pycnidia and exudate, while no growth was made by the latter. The ascospore cultures on maize meal, moreover, produced mature perithecia.

From the negative results obtained with the presumed pycnospores in germination and inoculation tests, and from their characteristic small size and appearance, it is concluded that these bodies are, in fact, spermatia. It is, then, the concentric spermogonial rings that impart the typical ring-spot appearance to the diseased foliage.

The recognition of the fact that *M. brassicicola* is a homothallic fungus with only one infectious stage (the ascigerous), spermogonia, and no conidia, points to its dissemination by wind, not water, a matter bearing directly on a correct interpretation of the disease cycle of ring spot, and on its control.

Saatidsforsøg med Kaalroer paa kaalbrokfri og paa kaalbroksmittet Jord. [Sowing date experiments with Swedes on club root-free and club root-infected soil.]—*Tidsskr. Planteavl*, l, 3, pp. 539–542, 1946.

Experiments to determine the influence of the sowing date on the incidence of club root [*Plasmodiophora brassicae*] on swedes in soils contaminated by the

pathogen in different localities of Denmark were conducted from 1931 to 1936. In general, the yields were substantially higher and the percentages of diseased roots considerably lower in stands of the first sowing on 9th April than in those of the second and third on 23rd April and 8th May, respectively. A date between 10th and 15th April also appeared from the results of trials from 1938 to 1944 to be the most suitable for the Bangholm variety in healthy soils, whereas a postponement until about the 20th is advisable in the case of Wilhelmsburger to prevent running to seed.

[This paper was also published as *Medd. Forsøgsv. Plantek. Kbh.* 376, 1945.]

LACKEY (C. F.). **Occurrence of curly-top virus in meristematic tissue.**—*Phytopathology*, xxxvi, 6, pp. 462–468, 1 fig., 1 diag., 1946.

Sections of sugar beet and bean [*Phaseolus vulgaris*] root tips, 0·2 to 0·4 mm. long, cut from fresh material held in paraffin wax and cooled in a refrigerator were tested for the presence of the curly-top virus in the meristematic tissues of the root cap below the first protophloem sieve-tubes [*R.A.M.*, xviii, p. 150], the sections being macerated in sucrose solution and leafhoppers allowed to feed on the solution and then on test plants. In 22 beet tests, each comprising 7 to 24 root tips, the average percentage of infection was 23·3. In 15 tests on beans, each involving 12 to 24 root tips, the average percentage of infection in sections measuring 0·4 to 0·5 mm. in length was 32·6. Confirmatory evidence of the location of the virus in the meristematic tissue of beet root tips was secured by feeding tests with the leafhopper vector [*Eutettix tenellus*] on infected root tips. In inoculation experiments on beets with suspensions in 5 per cent. sucrose solution of scrapings from the meristematic tissue of curly top-diseased tobacco plants, the incidence of infection ranged from 0 to 70·8 per cent., the maximum being secured with inoculum from young plants inoculated for two to three weeks. The corresponding range in a comparable series of trials with *Nicotiana glutinosa* was from 0 to 70 per cent. Apparently the virus concentration in the cambium decreased as the plants recovered. The author suggests that the virus passes from the phloem into the cambium and multiplies in the meristematic tissue.

BLODGETT (E. C.). **The Sclerotinia rot disease of Beans in Idaho.**—*Plant Dis. Reptr*, xxx, 5, pp. 137–144, 2 pl., 1946. [Mimeographed.]

The importance of Idaho as a producer of dry and garden seed beans [*Phaseolus* spp.] has led the author to investigate the increasingly wide and damaging distribution of *Sclerotinia sclerotiorum* rot since it was first recorded in the State by Anderson (*Plant Dis. Reptr*, xxv, p. 457, 1941). The use of combines and the practice of feeding the straw, the subsequent use of the litter, and the common practice of feeding cull beans to sheep have helped to disseminate the fungus, which attacks carrots, peas, and rape, as well as beans. Attention is directed to the importance of maintaining suitable rotations and the possibility of seed transmission.

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xx, 5–6, pp. 40M–44M, 1946.

BELGIUM. By Decree of the Regent dated 28th January, 1946, and taking effect as from 16th February, 1946, all insecticides, fungicides, weed-killers, and other anti-parasitic products may be offered for sale only after authorization by the Minister for Agriculture. Every product so authorized will be registered by the State Phytopharmacy Division, Gembloux. Applicants must state the description and content in active substances of the product, the purpose for which it is intended, the dosage, and the method of employment. The information given is confidential. The official list of authorized products will be published regularly in the *Moniteur belge*.

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ERRATA

VOLUME XXV

page 21 line 50 delete '*Phytophthora* sp.' after '*Rhizoctonia* sp.'

26 27 for 'bunt' read 'bent'

39 25 for 'mycelium' read 'mycetin'

42 20 for 'the latter' read 'this'

56 40 for 'Kock' read 'Koch'

58 30 for 'Posnette (A. E.)' read 'Posnette (A. F.)'

60 32 for 'Saville (D. B. O.)' read 'Savile (D. B. O.)'

64 20 for '*Triticum*' read '*Agropyron*'

21 for '*coerulea*' read '*caerulea*'

121 40 for '444' read '443'

131 15 for 'puratized L.N.' read 'preventol G.D.'

16 for 'preventol G.D.' read 'puratized L.N.'

156 35, 36 for '*Ammophila avenaria*' read '*Ammophila arenaria*' for '*S. avenaria*' read '*S. arenariae*'

52 for '*E.*' read '*Elymus*'

157 1 for '*coerulea*' read '*caerulea*'

166 29 for '1942' read '1943'

184 48 for '*Medd.*' read '*Meld.*'

185 24 for '*H. macrospora*' read '*M. macrospora*'

188 17 insert after 'with salt-free' 'but did so slowly from concentrated'

208 48 for 'Fang T. C.' read 'Fang C. T.'

231 23 for 'blast' read 'bast'

240 8 for 'gelactose, manumose' read 'galactose, mannose'

248 27 for '332–335, 1922' read '333–335, 1929'

263 18 for 'calico' read 'celery calico [cucumber mosaic]'

279 51 for '*pardoxa*' read '*paradoxa*'

280 12 for '*cespitosa*' read '*caespitosa*'

341 49 for '*Panogrolaimus*' read '*Panagrolaimus*'

346 12 for '*lolicola*' read '*loliicola*'

373 6 for '*Clinocodium*' read '*Clinoconidium*'

454 49 for '(*Dothidella cymadothea*] *trifolii*' read '(*Dothidella* [*Cymadothea*] *trifolii*)'

488 48 for 'ccxxii' read 'xxxii'

524 50 for 'xxvi' read 'xxv'

556 1 for 'E. W. Lindstrum' read 'E. W. Lindstrom'

583 18 for '505' read '45'

589 39 for 'McFarland (W. H.)' read 'McFarland (W. A.)'

1946

Additions and Corrections

to the List of Common Names of Virus diseases used in the Review of Applied Mycology (Vol. XXIV, part 13).

page 515 line insert 'Wheat virus 2 (green mosaic) McKinney 1937' as a synonym under '*Agropyron* green mosaic virus. McKinney 1944.'

516 insert 'Bean mosaic virus, 'new strain'. Dean & Hungerford 1946.' under 'Bean mosaic virus, 'new strain'. Richards & Burkholder 1943.'

520 18 for '*magninerva*' read '*magnivena*'

523 insert before 'Euonymus Variegation' the following new entry:
'Elm Phloem Necrosis R.U. Swingle, *Phytopathology*, xxviii, 757, 1938; *U.S. Dept. Agr. Circ.* 640, 1, 1942; D. M. McLean, *Phytopathology*, xxxiv, 818, 1944; *P.D.R.S.*, 150, 482.
Elm phloem necrosis virus Swingle 1938.'

524 insert after '*Humulus* virus 3. Smith *Tb.*' the following entry:
'Hop Mosaic Smith *Tb.* 193.
Hop mosaic virus Salmon 1923.
Hop false nettlehead virus Duffield 1925 fide K. M. Smith.
Humulus virus 1. K. M. Smith.'

24 delete '*Chlorogenus humuli* Holmes *Hb.*'
insert '*Chlorogenus humuli* Holmes *Hb*' under '? Hop Kräuselkrankheit or curl disease [virus].'

526 32 for 'McKinney, *J.Wash. Acad. Sci.*, xxxiv, 327–8, 1944.' read 'Grebennikov, *Trans. of conference on plant virus diseases, Moscow, 1940*, 107, 1941.'

530 27 for 'Kräuselkrankheit' read 'Blattrollkrankheit'
insert before 'Potato Mottle' the following entry:
'Potato Marginal Leaf Roll Quanjer, *Rept. Intern. Conf. Phytopath. & Econ. Entom., Holland*, 1923, 25, 1923.
Potato marginal leaf roll virus Quanjer, 1923.'

45 delete 'Potato common mosaic virus. Quanjer, 1923.'

531 10 for 'Quanjer fide Smith *Tb.*' read 'Quanjer fide Quanjer 1931.'

11 delete 'Potato top necrosis virus Quanjer, 1931.'

12 delete 'Potato acronecrosis virus Quanjer, 1931.'

39 insert 'may be' between 'Necrosis' and 'caused'
delete '& Potato virus A'

531 insert under 'Potato virus B. Bawden in Smith 1933, Bawden, 1936.'
'Potato top-necrosis virus Quanjer 1931 fide Quanjer *in litt.*
Potato acronecrosis virus Quanjer 1931 fide Quanjer *in litt.*'

532 4 delete 'Stipple streak virus. Atanasoff 1922 fide Smith *Tb.*'

8 delete 'Acropetal necrosis virus. Quanjer 1931.'
insert under '*Solanum* virus 2 (var.) Smith & Dennis 1940.'
'Stipple-streak virus. Atanasoff 1922 fide Quanjer *in litt.*
Acropetal necrosis virus. Quanjer 1931 fide Quanjer *in litt.*
Necrose das Nervuras. Nobrega and Silberschmidt 1944.'

25 insert 'Martin 1922; Folsom, *Bull. Maine agric. Exp. Sta.* 312, 1923' after '111.'

26 for 'Goss 1930' read 'Folsom 1923'

27 for 'Folsom 1923' read 'Schultz and Folsom 1923'

28 delete 'Potato marginal leaf roll. Quanjer 1923, Fernow 1923.'
insert 'Potato common mosaic virus Quanjer 1923 fide Quanjer *in litt.*' as a synonym under 'Potato virus A. Murphy & McKay 1932.'

page 533 line 20 delete 'New York potato yellow dwarf virus. Black 1941.'
538 28 for 'McKinney 1929' read 'K. M. Smith 1937'
543 35 for 'xxiv' read 'xxxiv'
45 delete 'Wheat virus 2 (green mosaic) McKinney 1937.'
544 6 for *galbanum* read *galbinum*
14 for 'McKinney, *J. Wash. Acad. Sci.*, xxiv, 327, 1944' read 'Zazhurilo & Sitnikova, *C.R. Acad. Sci. U.S.S.R., N.S.*, xxv, 9, 798, 1939'

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page 544 column 1 line 36 add '(str.)' after 'Potato virus Y'
2 53 for '*magninerva*' read '*magnivena*'
547 1 insert before 'Erigeron yellows virus' the new entry: '**Elm phloem necrosis virus** 523'.
549 2 43 delete 'New York potato yellow dwarf virus, see Potato yellow dwarf virus'.
551 1 2 add '(str.)' after 'Potato virus X'
1 7 for 'X' read 'A'
1 16 for 'Kräuselkrankheit' read 'Blattrollkrankheit'
1 24 for 'Potato marginal leaf roll, see Potato spindle tuber virus.' read '**Potato marginal leaf roll virus,** 530.'
553 1 30 add '(str.)' after 'Potato virus Y'
555 2 49–50 for 'Wheat mosaic virus (str.)' read '*Agropyron* mosaic virus (str.)'

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